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JPRS-UMM-84-015

15 August 1984

USSR Report

MACHINE TOOLS AND METALWORKING EQUIPMENT

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USSR REPORT

Machine Tools and Metalworking Equipment

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INDUSTRY PLANNING AND ECONOMICS

NATIONAL IMPACT OF OLD MATERIALS HANDLING SYSTEMS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 15 May 84 p 2

[Article by R. Sheleg, chief of the SKB [Special Design Bureau] of Warehouse Equipment and Mechanization and Automation of Warehouses, and B. Pevzner, chief engineer of the SKB, under the rubric "Manual Labor on the Shoulders of Machines": "The Center of the Complex -- the Warehouse"]

[Text] There is no enterprise without its warehouses. Up to 150,000-200,000 tons of freight pass through an average machine building enterprise every year. In order to accept it, arrange it in the necessary order, and deliver it to shops in time a great deal of labor is needed, frequently heavy labor. It is no accident that more than 2 million people are engaged in warehouse work.

Their labor can be made easier in only one way -- through comprehensive mechanization and automation. The example of the USSR Gossnab enterprises graphically attests to the advantages of this approach to the organization of work. There the introduction of new methods and technical means for processing freight has made it possible to increase labor productivity by a factor of 3 and theoretically liberate about 80,000 people. And, although in recent years freight turnover in the Gossnab system has increased by a factor of 7, the warehouse area has had to be increased by only a factor of 2.5.

To a significant degree these results were made possible thanks to the appearance of such equipment as stacker-cranes. As compared to gantry cranes and electric and gas lift trucks, they make it possible to increase storage height by a factor of 4-5, bringing it up to 10-15 meters, and reduce aisles between racks almost to the sizes of the freight. And expenditures for constructing warehouse buildings are reduced so much that even their metal content is less expensive than in open areas. But on the whole, stacker-cranes in combination with racks and transport conveyors make it possible to build automated warehouses with technical-economic indicators 2-3 times higher than where other equipment is used.

In our country today hundreds of mechanized and automated warehouses are in operation. But we need a significantly greater number of them. It is primarily the shortage of contemporary warehouse equipment that prevents meeting it. But because of limited capacities, its basic suppliers --

Mintyazhmash [Ministry of Heavy and Transport Machine Building] enterprises -- cover only 20 percent of the demand for, say, stacker-cranes, while for similar machines with a load capacity of 8 and 12.5 tons, they cover only 15 percent.

In this situation, 28 (!) ministries and departments, deprived of the opportunity to acquire necessary amounts of equipment, organized its production at their own enterprises. For example, while the Mintyazhmash produces 3,000 stacker-cranes on the average every year, the rest of the sectors produce another 1,000. One can hardly object to such a solid increase. But the trouble is that there are many machines among this thousand whose technical level leaves something to be desired.

The causes of the failures are already built into the planning stage. According to incomplete data, about 40 organizations in various sectors are engaged in manufacturing warehouse equipment today. But the question is, what are the results? You be the judge. Quite a lot of time and effort was expended , for example, by the Minavtoprom [Ministry of Automotive Industry] to manufacture its own stacker-cranes after which it ... acquired a license abroad and are now trying to incorporate it. Goskomsel'khoztekhnika is following the same path. The stacker-cranes it is producing at this point are far from perfect.

The most unfortunate thing is that the warehouse equipment built according to the designs of these 40 organizations often have nothing in common. Different design decisions and assembly components practically exclude the possibility ofstandardization and centralized servicing, repair, and supply of spare parts. In this situation it is also difficult to monitor the level of development work.

The conclusion is evident: the development and production of equipment for warehouses must be implemented on the principles of a unified technical policy. In order to translate it into life, an organization is needed whose recommendations would be compulsory for everyone. Correspondingly, designs and new developments would obtain the right to be introduced only with its agreement. In principle these duties could be entrusted to our SKB. But today, despite "head" status, it has no rights nor power to influence the work of the design organizations of other sectors. The Mintyazhmash turned to the USSR State Committee for Science and Technology with this proposal. But unfortunately, the matter has made no further headway than recognition of the importance of the question. But it must be solved. Among other reasons, in order to coordinate efforts.

In order to increase the production of highly efficient warehouse equipment, measures must also be taken to concentrate production potential. As early as the beginning of the last five-year plan, the Mintyazhmash introduced a proposal to build a new plant for producing mechanized and automated warehouse equipment in the city of Vichuga, Ivanovo Oblast. In combination with the reconstruction of the Stakhanov Machine Building Plant and the Krasnogvardeyskiy Crane Plant -- today's main suppliers, this measure promised a fundamental solution to the problem. But the necessary capital could not be found at that time. But today, on the threshold of the 12th Five-Year Plan,

it would be proper to return to this proposal. And to try to implement it through coordination: if the sectors interested in obtaining warehouse equipment transferred a share of their own capital to the Mintyazhmash to build new specialized capacities, then as a result both sides would benefit.

It is understandable that time is needed to build new capacities, while the shortage of equipment for warehouses already exists today. Its production may be increased by manipulating existing capacities and specializing production. Take the same Stakhanov Machine Building Plant, for example. It is the only enterprise in the country which manufactures more than 10 types of stacker cranes. But simultaneously appearing in its program are jib cranes, excavating machines, railroad switches, pipeline fittings, and other items whose production may be fully entrusted to other enterprises.

The Mintyazhmash, in particular the head of the department of heavy transport and road construction machine building O. Pashenko, has repeatedly raised the question of transferring the Stakhanov Plant's nonspecialized output to enterprises of interested ministries and departments to Gosplan. Nonetheless, at the present time Gosplan specialists, for reasons unknown, are adopting a wait-and-see attitude.

The question of racks is no less crucial. The annual demand for these metal designs totals 150,000-170,000 tons. But Mintyazhmash enterprises are satisfying no more than 10 percent of this demand. Consequently, many users still rely on the USSR Minmontazhspetsstroy [Ministry of Installation and Special Construction Work]: it supplies a large share of the racks in the total volume of installation-construction work. But they are not a specialization of the ministry. Meanwhile, by entrusting centralized production of racks to the USSR Minmontazhspetsstroy, the problem could be solved with minimal expenditures of effort and capital. The sector has the capacity to produce the necessary metal designs and enterprise personnel do not need to be retrained as during attempts to expand production in the Mintyazhmash system. Judging by deputy minister K. Kochanov's reaction to our proposal, USSR Minmontazhspetsstroy specialists do not exclude the possibility of producing racks. But in order to do this, the appropriate decision is needed.

There is yet another component of warehouse equipment which should be specially noted -- control units for stacker-cranes. Assembly components for them, which the Cheboksary Electrical Equipment Plant of the Minelektrotekhprom [Ministry of Electrical Equipment Industry] supplies, do not accomodate users in price, in sizes, or in reliability. In particular, because of this many sectors have begun to build their own systems of automated control. And even in the electrical equipment industry itself where the head institute on the problem is -- the VNIIelektroprivod [All-Union Scientific Research Institute, Planning and Design Institute for Automatic Electric Drive in Industry, Agriculture, and Transportation], these questions are solved (sometimes even with great success) by other organizations. It seems it is time for the Minelektrotekhprom to demand a more responsible attitude from both the plant and the VNIIelektroprivod toward the tasks posed.

Speaking at a meeting with inventors, General Secretary of the CPSU Central Committee Comrade K.U. Chernenko expressed concern regarding the fact that we are reducing the ratio of heavy physical and unskilled labor in industry and construction slowly. The automation and mechanization of loading and unloading work, including in warehouses, is one of the key questions of this problem. It seems to us that it should be discussed at the USSR Gosplan with the participation of the State Committee for Science and Technology, the USSR Gossnab, the Mintyazhmash, and other interested ministries.

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CSO: 1823/289

ARMENIAN DESIGN INSTITUTES FACE UP TO NEW DEMANDS

Yerevan KOMMUNIST in Russian 23 May 84 p 2

[Article by V. Adzhemyan, deputy general director of the Armstanok NPO, candidate of technical sciences, under the rubric "The Routes of Technical Progress": "The Future of Our Machine Tool Builders"]

[Text] The decree adopted by the CPSU Central Committee and the USSR Council of Ministers "On Measures to Accelerate Scientific-Technical Progress in the National Economy" poses new challenges for the republic's machine tool builders. In coming years domestic industry must produce machines, equipment, instruments, and materials which meet the best world standards.

Scientific research and planning and design organizations must substantially increase the efficiency of research and development. Collectives' efforts must be directed to creating fundamentally new types of equipment and technology which insure efficient consumption of fuel-energy, material, labor, and raw materials resources. These requirements are directly related to the activities of the Armstanok NPO [Scientific Production Association] as well.

In recent years the amount of research and development we are doing to make it possible to significantly increase labor productivity and comprehensively mechanize and automate production processes has been rising. Simultaneously we are working on reducing the metals-intensiveness of items, reducing losses of metal, and using raw materials efficiently. The proportion of this subject area is to be increased by 40 percent in 1984-1985.

The volume of research and development work introduced and the proportion of work performed on the invention level is increasing at a rapid rate. The per unit economic effect from utilizing completed NPO developments in the national economy totaled 4.5 million rubles in 1983, while this year not less than 6 million rubles is anticipated.

Nonetheless the results achieved are not the limits of our capabilities. Scientific-technical progress in the sector should be insured by a fundamental increase in the technical level of items being produced at the present time and reorganization of their production on the basis of contemporary methods and means. The goal is to insure high productivity and quality, flexibility with respect to readjustment, and other parameters of items.

Contemporary trends in the development of production of metal-cutting machine tools dictate the basic directions of research and development. In the first place, this means progress in microprocessor electronics and its application in the design of new machines. The number of functions economically expedient using programmed control systems or programmed command devices is growing rapidly. The incorporation of production of machine tools equipped with digital programmed control and other means of automation is an urgent challenge for the republic's machine tool plants. The next, higher stage is the creation and production of machine tool robotized complexes to achieve so-called "humanless" technology. We have adopted this direction in conjunction with the plants. It will be further developed in the 12th Five-Year Plan.

In addition to a lathe with digital programmed control which is being incorporated at the present time, highly productive cartridge-type modifications, machine tools with direct current main drive, and other design concepts will be developed for the Yerevan Machine Tool Plant imeni F. Dzerzhinskiy. Some of the machine tools are expected to be manufactured in a robotized variant, which will serve as the basis for the production of automated sections of lathe manufacture.

The Kirovakan Precision Machine Tool Plant and the Oktemberyan Machine Tool Plant are planning production of a range of drills of various standard sizes. Among them will be small machine tools with digital programmed control not only to perform drilling, but also milling and boring operations. The aggregate principle of building machine tools will make it possible to compose automated sections in the future without particular difficulties.

The Yerevan Milling Machine Plant and the Charentsavan Machine Tool Plant are setting up production of several modifications of metal-cutting equipment of differing degrees of automation with an efficient control system and numerical display. By the way, the Charentsavan machine tools are the most metal-intensive in the republic. In order to conserve metal and improve the dynamic features of the items, there is to be an attempt to substitute concrete beds for pig iron ones. This task is practical; such an experiment is being conducted in several foreign companies.

A plan for joint work on developing and organizing production of a number of new specialized belt-grinding, abrasive-planing, and other types of machine tools has been compiled with the Leninakan Grinding Machine Plant.

One of the important challenges is the efficient utilization of the capabilities of the contemporary cutting tool. The durable, multilayered surfaces of the hard alloy tool not only sharply increase its life, but also make it possible to cut metals with great rapidity. This will require the creation of high speed axle assemblies. Preliminary results of our research on the use of a "freon-oil" compound as a lubricating and cooling medium give reason to assume that the problem will be solved and cutting speed may be increased by a factor of 1.5 to 2.

There is a need to introduce such technical-economic measures which would lead to insuring the stable quality of items and the creation of specialized

production facilities and cooperation. Every year the republic's machine tool plants produce more than 450 types of gears for a total of 250,000 units. It would be advisable to centralize this production using an automated system. Technical proposals on this question are being reviewed at the present time in order to implement a project in the 12th Five-Year Plan.

We are planning other developments for the purpose of introducing no-waste and low-waste production processes. For example, work on introducing the technology of obtaining stamped pieces from round semifinished articles is being conducted in conjunction with the Charentsavan Instrument Production Association. This will produce a saving of 250,000 rubles per year and will conserve at least 500 tons of metal.

The target program on efficient utilization of raw and processed materials gives a special place to expansion of the use of powder metallurgy. That is the position of our Armenian Scientific Research Institute of Technical Information on Machinery Manufacture. The question of re-use of chips of rapid cutting steel to manufacture tools by the powder metallurgy method must be solved.

It must be noted that in order to successfully solve certain technical problems, joint work with other related institutes should be expanded. Unfortunately, as yet there is no cooperation between us and the republic Academy of Sciences; this could solve questions of substituting other materials for stainless steel and obtaining all kinds of abrasive pastes.

In the next five-year plan, the machine tool and instrument industry will enter into a qualitatively new stage of development.

In connection with this, the question of the training and indoctrination of the new generation of specialists worries us. Young specialists who have graduated from the Yerevan Polytechnic Institute imeni K. Marx and gone to work in scientific productions association are inadequately trained and are behind the demands of the time. This especially applies to design personnel, who should have not only good theoretical knowledge but elementary practical skills as well. Years pass before young specialists acquire them, understand the specific nature of our work, and develop the ability to solve problems independently. This is intolerable in light of the contemporary rate of scientific-technical progress. Obviously the time has come when it is necessary to review many instruction programs for the "Technology of Machine Building" course and bring them into line with the challenges of today and tomorrow.

A great deal of know-how in machine tool building has been accumulated in our republic. Our immediate prospect is to develop a new generation of metal-working equipment on the level of the best world standards.

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CSO: 1823/274

LOW USE OF NC MACHINES DUE TO LABOR SUPPLY PROBLEMS

Kiev PRAVDA UKRAINY in Russian 2 Jun 84 p 2

[Interview with P. M. Vanat, second secretary of the Zaporzh'ye party gorkom, date and place not specified]

> [Text] Raising the shift coefficient of equipment was named as one of the most important problems in the development of the national economy of the country at the December (1983) Plenum of the CPSU Central Committee. It is precisely to this that the initaitive is directed in "To each machine tool -- the highest productivity" approved by the Central Committee of the Ukraine Communist Party. Among other leading collectives of the republic, the "Zaporozhtransformator" Association workers came forward. What reserves do Zaporozh'ye workers search for to increase the efficiency of the machine tool part, what problems and difficulties are met with in the process of the search? This is the subject of the interview between our correspondent A. Rekubratskiy and P. M. Vanat.

[Question] As mentioned at the oblast report-election party conference, new capacities are being put into operation and the equipment park is being increased at many Zaporozh'ye enterprises. But there is still no proper concern about its efficient utilization. As a result the output-capital ratio is reduced, the capacities are not loaded sufficiently and the shift coefficient is low. What solutions to these problems are being proposed by the city party organization?

[Anser] The crticism is correct. As far as conclusions are concerned the entire complex of the planned work is reflected in the socialist obligations of Zaporozh'ye workers for 1984. They decided to achieve an increase of one percent above the plan in productivity and, in addition, a reduction of 0.5 percent in the production cost. The ways for the search were determined. The party gorkom monitors question of a further introduction of new equipment, the development of the brigade form of organization of labor and the movement of multimachine tool operators. It should be noted that the fight to reduce idle time of equipment was developed everywhere.

There are many reserves here. We can say that over 500 NC machine tools were installed at city enterprises. This equipment is very expensive - such a machine tool costs about 100,000 rubles. Its service life is ten years on the average. Whether it produces or not, each year it adds 10,000 rubles to the production cost. Af first it was sssumed that the introduction of an NC machine tool would increase the productivity of labor considerably and pay for itself rapidly. However, as shown in practice, this does not happen at the majority of enterprises. At the Machine Plant, 13 NC machine tools are being loaded only 15 percent; at the "Zaporozhstal'" Plant such a machine tool is being used without programs, i.e., as a common metal-cutting tool. The NC machine tools at the Plant imeni Voykov and the "Dneprospetsstal'" operate only a partial shift. The shift coefficient of NC machine tools is 0.6 to 0.8.

Anticipating your question on why we are utilizing the latest equipment so poorly, I will say that specialists already in May of last year, knew the reasons for the gap between the possibilities of NC machine tools and their actual utilization. It was found that it takes about three months, as a rule, to install and adjust an NC machine tool. Shortcomings in the design of the machine tool and control systems have an effect. But the losses are much higher due to organizational omissions: Tools and intermediate products are not fed to work positions on time, there are not enough adjusters, programers, or operators. Frequently machine tools are loaded with simple to make parts.

[Question] What measures have been taken to correct the matter?

[Answer] We called upon our scientists to solve the most complicated problems, for example, the Design-Technological Institute of Agricultural Machinebuilding along with doing scientific technological research on utilizing NC machine tools, also began on-the-job training of specialists. Last year alone over 250 control programs were prepared for lathes, drilling and milling machine tools, which were then introduced at the Zaporozh'ye machine tool and tool plant. At present the question posed is considerably broader: we are organizing centralized equipment servicing of NC machine tools. A comprehensive technical service department at the Kharkov Center began operating in Zaporozh'ye,

[Question] By the way, PRAVDA UKRAINY recently published an article "Sleeping electronics," in which the problems of the Khar'kov Technical Service Center for such machine tools was described.

[Answer] This article also helped us in organizing a branch. The party gorkom held a conference with the participation of I. A. Krasnov, director of the center, and leading specialists of the city enterprises, provided publicity and helped in solving a number of problems. Although it is still early to sum up, I want to note that it was possible to reduce the building up process and avoid some errors. The staff workers of the department began doing specific work in the very first days on setting up and servicing NC machine tools at city enterprises.

[Question] So far the ratio of NC machine tools in industry of the city is not very high. What are the reserves of the remaining machine tool park?

[Answer] I can say that the centralized provision of work positions with documentation, fixtures, intermediate products, measuring instruments and cutting tools has already brought considerable advantages. The course was also taken to develop multimachine tool operators. At present, in the Motorstroitel' Association, 22.5 percent of the workers service several machine tools, and a third of these production workers work on three and more machine tools. A labor example is shown by Communists automatic lathe operators M. V. Koziy, A. A. Borishpoletz, and operators L. I. Kuz'micheva and V. S. Korniyenko. They are considerably ahead of the five-year plan task and have increased the productivity of labor by 30 to 40 percent. A system was developed and introduced in the association for material and moral incentives for multimachine tool operators. The party gorkom is concerned about expanding the experience of the motor builders in the city.

We anticipate that there will be many obstacles on this road. Let us take the cooperation problem. In the "AvtoZAZ," "Zaporozhtransformator" and Motorostroitel'" production associations, underloaded machine tools were taken into account. Now they manufacture parts for other shops and plants in their systems. The advantage of cooperation was also understood immediately by other managers. This is the reserve which was, as they say, within easy reach of one's hand. But when it came to cooperation between enterprises of different ministries, many began at once to look for "objective" reasons to prove the disadvantage of this.

The party gorkom had to remove interdepartmental barriers very often. Today the systems of automatic furnaces in the electrode plant and abrasives combine, developed by the Zaporozh'ye branch of the "Tsvetmetavtomatika" Institute, are operating with a high shift coefficient. But this was not always so. It was necessary to overcome much various interdepartmental friction.

In conclusion, I would like to say that the party gorkom also sees clearly the shortcomings along with the first successes. Let us say that at many enterprises work is only now being developed on certification and accounting and the possibilities of the brigade contract are still not being fully utilized. We see that our problem is to make the movement to increase the shift coefficient of equipment become of vital interest to each Communist and each primary party organization in the machinebuilding sector.

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CSO: 1823/295

INSTITUTE DIRECTOR ON DEVELOPMENT IN CAD/CAM, FMS, ROBOTICS

Moscow, EKONOMICHESKAYA GAZETA in Russian No 26 Jun 84 p 16

[Article by Eduard Iosifovich Krukovskiy, director of the TsPKB MA of Minpribor]

> [Text] The basic problem being solved at present by the Central Planning Design Bureau of Mechanization and Automation (TsPKB MA) of the Minpribor [Ministry of Instrument Making, Automation Equipment and Control Systems] is the creation of progressive technologies with high productivity equipment, fixtures and tools for the enterprises of the sector. E. I. Krukovskiy is its director and honored worker of the Latvian SSR industry. After being placed in the reserves of the USSR army in 1957, he became a lathe operator at the Tallin "Dvigatel'"and a student at the Mechanical Department of the Tallin Polytechnical Institute. He has held a number of engineering positions. Since 1964 he has been working at the TsPKB MA, where he went from laboratory chief to Director of the bureau. He heads the Council of Directors of the Riga Proletarian Rayon.

A qualitatively new step in the area of mechanization and automation of production is the introduction of manipulators, robots and robot equipment complexes (RTK). The order of the Minpribor established the TsPKB MA, the head organization on robotizing machining and equipping the RTK. A design-technological robotization department was organized in the bureau with proving facilities for "teaching" robots and for debugging the complexes.

The Main Directions of the Search

In a short time there were developed, in particular, typical solutions for robot equipment complexes, including a number of variations from which it is possible to create a multiplicity of special RTK depending upon the kind of machined parts. Last year, for example, two sets -- threading and drilling were manufactured, on the basis of a typical one, for the Kazan "Teplokontrol'" Association. Their introduction freed tens of metal-cutting machine tools (turret, drilling, threading). The labor of 12 workers was saved -- machine tool operators, adjusters, transporters. A considerable area was

also freed. The production cost of machining parts was reduced by 30,000 rubles per year. Design-technological documentation for typical RTK and two special complexes that we manufactured were released by a departmental commission which recommended them for production and introduction in enterprises of the sector.

We devote much attention to the development of flexible automated productions (GAP). They are becoming more and more necessary because of the rapid changes in products.

Today our specialists are developing GAP at the Mogilev "Tekhnopribor" Plant. Seven more collectives were involved in this matter.

Frankly speaking, as a head organization we encountered many difficulties in "joining" all GAP links. First of all there was no automatic technological equipment, necessary for GAP machining. Also, the available equipment is not adapted to joint work with robots and computers. It was found difficult to acquire the necessary computers and their peripheral devices.

We consider it necessary to attract the attention of the GKNT [State Commottee of the USSR Council of Ministers on Science and Technology] and the Minpribor to this problem. In fact, it was precisely the GAP that led right up to the development of technologies and production facilities, where "self-controlled" equipment will replace man at all stages -- from feeding raw materials and intermediate products to accounting for and warehousing finished products of guaranteed quality.

The GAP are an important link in the comprehensive automation of production. But the maximum effect of their utilization may be achieved only when the entire "chain" is automated from calculations and design to the output of the products.

In this connection the development of automatic systems (SAPR) using computers that shorten the time and improve the quality of designs becomes of great importance.

We already have available a series of such systems and, on the basis of the "Avtoshtamp" SAPR, a regional center was created for the automatic design of dies for the Minpribor. There was a possibility of providing enterprises in the Soviet Baltic republics with automated designs of such tooling.

I will stress that SAPR has considerable economic effect in the national economy. Thus, the system for the automatic preparation of control programs for three-coordinate (volumetric) machining on NC milling machine tools at only eight enterprises in the sector saves 575,000 rubles.

At present, the bureau is completing work on developing systems for the automatic preparation of control programs for lathes, drilling and jig-boring groups of NC equipment. In the future -- we will develop systems for the automated design and manufacture of compression molds for casting thermoplastics.

It is Necessary to Concentrate Forces

I would like to share some sore subjects. There has been a discussion for a long time on the periodic certification of NII [Scientific research institute] and KB [Design institute] on the results of which a decision must be made either on their intensive development or elimination, if they are using state money in vain, without return. However, were any NII or KB closed as being useless? I cannot recall even one. Yet, unpromising bureaus and weak institutes that do not even have experienced production facilities have multiplied excessively. This means a scattering of forces and cadres and more costly design work: in fact, the control apparatus and overhead costs increase everywhere.

We see that the main road for developing science in the sector is the concentration of the scientific and technological potential in large NII and KB with their own experimental plants. The TsPKB MA has precisely such a structure. This makes it possible for us to carry out our development as follows:

scientific research work borrowing achievements of science;

experimental -design work, including building prototypes of individual units in an experimental production facility;

manufacturing and debugging samples at the experimental plant;

their introduction at enterprises and supervision of their industrial operation;

final finishing of experimental samples according to results of industrial operation, and manufacturing series produced products at the experimental plant.

In my opinion, such a structure and the organization of the bureau's work are the most optimal for raising the efficiency of the specialists, reducing the time for introducing the developments and raising their quality. In substantiation I can say that the collective of our bureau executes the thematic plan fully. At present, we can distribute and complete the assigned subjects regularly which shows in the higher quality of the developments.

Independence and Responsibility

As director of the bureau and as chairman of the Council of Directors of the Rayon I frequently see attempts to show initiative and independence run into a multiplicity of instructions and rules that contain unjustified limitations, trivial regulations and, frequently, contradict each other and are not in the spirit of the time.

For example, NII and KB are blamed for not having enough workers, although the plans are completed with respect to the subjects, volume and efficiency. In particular, the "Soyuztekhpribor" VPO [All-Union production association] blames only our bureau for this. Why? We should be awarded for this.

We follow attentively the experiment on improving the organization and wages of designers and technological services in a number of Leningrad enterprises. There the wages of freed specialists become a kind of incentive fund for those who produce the highest creative yield.

There is no doubt of the efficiency of this arrangement in our opinion. There appears to be an additional possibility to secure highly skilled cadres and, at the same time, it becomes unnecessary to fill vacancies mechanically. It would be desirable to accelerate the widening of the frame of the experiment I believe that many NII and KB managers would agree.

Here is another special case: NII and KB are forbidden to overfulfill the plan for economic contracts although this is the shortest route to introducing new progressive developments into production. Finally, it happens that NII and KB are given planned figures of the economic effect and material and power resources that are entirely unrelated to the structure and subject of the plan. The waves of accounting paper are literally overwhelming. Besides the indicators legalized by planning and statistical organs, the VPO sends us 10 more planned indicators and 24 more indicators to be taken into consideration. The use of these for the job is minimal.

Or let us take the introduction schedules -- this "eternal" theme of developers. Today there are 10 items of typical equipment in the bureau portfolio for tool production and six items for small mechanization facilities. They are needed at enterprises now, but 2 to 3 years will pass before it is possible to place them in series production.

Thus, for a number of years we cannot find a manufacturing plant for an engraving-grinding machine tool, contour lapping machine tool and a set of fixtures for profile grinding. We have turned for help many times to our VPO and the ministry. Without results. But somebody, in fact, must not only pose problems, but also care about a realistic and practical way to implement their solutions.

In our opinion, the time has come for strict regulation of the introduction and mastering of progressive technical innovations. The more efficient the development is, the greater the benefit from its accelerated application, and the greater the loss from the delay. The responsibility for this should also be obvious.

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CSO: 1823/296

UDC 621.9.06.002.2

NEW GENERATION MACHINE TOOLS DISPLAYED AT EXHIBITION

Moscow MASHINOSTROITEL' in Russian No 3, Mar 84 pp 41-43

[Article by I. P. Pozdnyakov, engineer, "Equipment for Machine Assembly Plant"]

[Text] At the "Special Technological equipment manufactured by machine-building sectors" interindustrial exhibition, held in the USSR VDNKh, machinebuilding ministries displayed machine tools, semiautomatic and automatic lines, manipulators and other progressive equipment. A considerable part of it can be used in various machinebuilding sectors.

A vertical revolving milling machine tool for finish machining of precise planes by face milling, using el'bor-R, was developed by the "Nasosenergomash" NPO [Scientific-Production Association] imeni 60-letiya SSSR (Sumy) on the basis of the model 3Ye756 machine tool.

A set of tooling was designed and introduced for multitooth el'bor milling as follows: gang universal cutters; cutters from el'bor-R of a new design that have higher reliability and allow 10 and more resharpenings; a device for group sharpening of cutters; a device for adjusting a cutter to size outside the machine tool; special spindle units.

The milling process has very low thermal stress and prevents surface scorching. The cutters, 300 mm in diameter, used make it possible to obtain regular microroughness on friction surfaces. The intensity of the removal of metal (from 0.6 to 3.0 mm in one pass) increased 30 to 40 times as compared to grinding. With el'bor milling the height of microscopic surface irregularities is 1.25 to 0.63 micrometers.

The model MA655BF3 five-coordinate vertical milling NC machine tool, developed by the ENIMS [Experimental Scientific Research Institute of Metal Cutting Machine Tools], was designed to machine globoidal cams and other complicated curvilinear slots in solid of revolution type parts 110 to 300 mm in diameter and up to 250 mm long. The shape of the slot is machined by end cutters made of high speed steel and hard alloys.

The machine tools is operated automatically by five controlled coordinates: two circular and three linear, each equipped with a feedback sensor. The

working surface of the table (500x1250 mm) moves in the longitudinal direction (500 mm) and transverse direction (1000). The greatest rotation angle of the cutting head is ± 70°.

Multispindle readjustable machine tools with standardized units designed by the "VPKTIstroydormash" NPO (Kiev) are intended for drilling 8 and 4.5 mm diameter holes and threading housing parts on one, two and three sides.

The machine tools are readjustable for machining parts similar in dimensions and configuration by changing the set up devices, spindle units and plates as well as the tools. After the part is secured in the device, the "Tsikl" button is pushed and, bringing the tool to position; the working feed and withdrawal of the tool to the initial position are accelerated. The part is clamped and unclamped by a pneumatic drive.

The introduction of these machine tools raised the productivity of labor considerably, reduced the labor intensiveness of manufacturing and produced a large economic effect.

The machine tools were introduced into the following plants: 24th party congress, the Vyborg "Elektroinstrument," the Kiev Cement Machinebuilding imeni Kalinin Plant, the Kremenchug Road Machine Plant etc.

The four-spindle semiautomatic drilling machine was developed by VNIIPTkhimmash (Penza) for drilling holes 27 mm in diameter and 80 mm long for connecting bolts or pins in flange type parts. It can be used in all machinebuilding sectors with series production.

The machine tool consists of a welded box-like bed, an independent 5U4061 hydraulic head, a feed panel, a spindle adapter with four spindle units, an indexing table with a rotary faceplate and self-centering clamping device, a tool cooling system, a flange clamp and a device to monitor coaxiality. The use of this semiautomatic machine tool increases the productivity of labor fourfold by reducing the share of manual labor and, due to the simultaneous utilization of four spindles, makes possible multimachine tool servicing (all operations, except for securing the part on the faceplate, are automatic), and produces a significant economic effect; it also raises the production standard.

The profile grinding NC machine tool was developed by the ENIMS to machine open or blind inner and outer surfaces of complicated shapes with a linear generatrix: epitrochoids of rotary drive stators, curvilinear surfaces of stators for hydraulic pump cams, templates, dies etc. When truing a disk with a shaping tool it is possible to machine nonlinear generatrices. The machine tool may be utilized for jig-grinding work. A special adjustment makes it possible to machine shafts on centers with a shaped generatrix.

The high precision of the dimensions and shapes of surfaces was obtained by using a number of original design solutions of individual units as follows: roller guides are used on the cross-shaped table as are screw gages with high precision supports, gears without gaps with variable pitch worms etc.

Precise initial positions of the movable units are provided by electrical-contact sensors whose signals are combined with phase signals of the condition of the stepping drives. High rigidity of the machine tool was achieved by ribbing the base parts.

The hydraulic drive for moving the grinding stock with a replaceable grinding spindle on high precision roller contact bearings makes it possible to work with oscillations of the grinding wheel. The spindles are rotated by an induction motor or a high frequency motor. High speed electrical spindles may be used.

The machine tool is equipped with an N55-1 NC that positions the machine tool units automatically into the initial position, shifting the "zero," digital indication of all movements, automatically selecting gaps in the mechanical system of the machine tool when the table is reversed and compensates for inaccuracies in its movements, related to errors in the feed screws.

The helical vibration equipment for machining parts was developed by the Dimitrovgrad Automatic Machine Plant imeni 50-letiya SSSR. It may be used in any sector of industry.

By regulating the frequency and amplitude of the oscillations and selecting abrasive material with the required physical properties, the device does various kinds of machining: removes burrs after machining, die casting, stamping; cleans off scale and oxide film after casting in sand molds; polishes surfaces of metal parts and prepares parts for electric plating.

The equipment has a new electrical motor of the 4AV180V6U series with forced lubrication of bearings. The counterweights are mounted directly on the shaft of the electrical motor and the working surface of the basin (its volume is 850 liters) is covered with urethane.

The annual saving from its introduction will be 64,000 rubles.

The EILV-4 equipment for electric spark toughening of tools was developed by the Voroshilovgrad PTImash and was introduced by a number of enterprises.

In the process of electric spark alloying the working surface of steel tools (shaping and slicing cutters, hobbing, slicing and end cutters, drills, taps etc.) with a hard alloy, particles of the hard alloy are transferred from the electrode to the surface of the tool, forming a strong coating 0.01 to 0.12 mm thick close in its properties to the hard alloy. As a result, tool resistance to wear is increased 1.5 to 2.5 times, and its cutting properties are improved which makes it possible to raise the machining modes by 10 to 20 percent. The productivity of the equipment is 3 to 6 cm^2/min. The annual saving by using one equipment is up to 20,000 rubles.

The equipment consists of a source of pulsing current located on a table, an electromagnetic vibrator and a set of fixtures for securing various types of tools.

A protective gas atmosphere may be used in the alloying process (for example, containing nitrogen, argon) which provides high purity of the processed surface (a height of the microroughness 20 to 80 micrometers). "Soft" modes and a higher vibration frequency of the electromagnetic vibrator are provided for strengthening a precision tool.

The introduction of EILV-4 equipment for the electric spark strengthening of tools at the "Zhdanovtyazhmash" PO, at the Kaluga Machinebuilding Plant, the Voroshilovgrad Crankshaft Plant imeni 20-letiya Oktyabrya and a number of other plants has demonstrated their reliability and efficiency.

[Excerpt] A type TK-45 fixture for model 16K20RF3S5 for NC machine tool was designed and manufactured at the Odessa Milling Machine Tool Plant imeni S. M. Kirov.

The changeable table of the fixture is mounted on the turret head of the machine tool. Cutter- and drill-holders are mounted on the table. The tools are secured in these holders in a certain order with minimum intervals between them according to the cyclogram for turning the part. In this case, idle runs, the bringing to and withdrawals of the turret head are reduced to a minimum, the necessity of rotating the turret head is eliminated which saves a considerable amount of auxiliary time. The fixture makes it possible to machine a group of parts. Adjustments for frequently repeating parts are made easily which saves time. The productivity of labor doubles when this fixture is used.

Tooling (12 sets) for high productivity cutting gear teeth moduli 12, 14, 16 and 18 mm in rims of support-rotary devices was introduced at the Ivanovsk Plant of Automobile Cranes. The set includes a hinged gear-cutting head, modular disk cutters and a hydraulically operated setting-clamping fixture.

The gear-cutting head is mounted on the carriage of a model 5A342 machine tool. The electrical motor of the head rotates the spindle at the end of which are installed modular disk cutters 340-380 mm in diameter for rough and finish milling. High speed steel blades are inserted and secured in grooves of slots in the cutter housing by means of wedges. The setting-clamping fixture is a cup with basing surfaces for the simultaneous milling of three rims 1450-2300 mm in diameter. The fixture has six hydraulic clamps actuated by a distributing device of the hydraulic station. The introduction of tooling made it possible to reduce machining time of the rims to 0.45 of the previous time.

Prefabricated worm cutters (m=2.5...6.5 mm) with a ground (unrelieved) shape of replaceable racks were developed at the Minsk PKTI [Planning Design and Technological Institute]. The manufacturing technology of these cutters makes it possible to obtain class V accuracy (GOST 9324-80).

The cutter housing has slots in the shape of half of a swallow's tail in which Г-shaped cross section replaceable racks are secured. Their working shapes are machined in the housing as is the usual helical surface of a cylindrical worm on threading-worm-grinding machine tools. The cutters with

the ground shape of the racks have greater rear angles as compared to the relieved shaped racks, a lesser roughness of the rear surfaces which increases their resistance to wear between two resharpenings to 2.5 times (their total durability is 5 to 6 times greater than that of cutters with a relieved shape). As a result, the productivity of gear cutting is increased up to 60 percent. Such cutters were introduced at the Minsk Tractor Plant and at the Minsk Gear Plant.

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2291
CSO: 1823/299

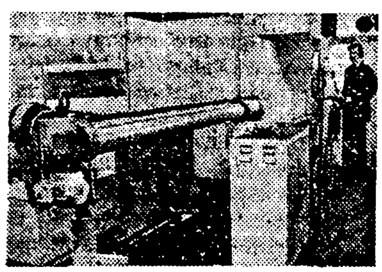
NC TURRET LATHE FOR TWO-SIDED MACHINING DEVELOPED

Moscow EKONOMICHESKAYA GAZETA in Russian No 19, May 84 p 9

[Article by author unknown, "NC Automatic Machine"]

[Text] An NC multioperational turret lathe (shown in picture), manufactured by the Novosibirsk Machine Tool Plant imeni 16th party congress is distinguished by the beauty of its shape and convenience in servicing and high productivity. It serves for comprehensive two-sided machining of highly complicated parts from rods in the automatic mode. Its use is most efficient in small and medium series production when readjustments are made every 0.5 to 6.0 shifts. The operational introduction of the program is implemented directly at the machine tool.

One operator can service two automatic machines when grinding single intermediate products and three-four machine tools when machining rods.



2291
CSO: 1823/284

MACHINE TOOL REPAIR FACILITIES IN BALTIC DESCRIBED

Riga NAUKA I TEKHNIKA in Russian No 3, Mar 84 pp 14-15

[Article by Z. Inesis: "Plant Renovates Machine Tools"]

[Text] Since the Machine Tool Repair Plant appeared beside the Chemical Fiber Plant, the word "Daugavpils" has become still more popular. Plants in the Baltic republics, Belorussian SSR and the Kaliningrad oblast are cooperating with the enterprise.

This cooperation has justified itself. At least because each plant and factory does not have to repair its own equipment. This is done in a centralized manner; moreover it is of high quality, using modern high quality equipment.

Metal-cutting machine tools come out of these walls almost like new and not only on the outside. It is no accident that they are guaranteed for a year just like new machine tools.

To provide this high quality, machine tools which sometimes appear "unreliable" are inspected thoroughly. After preparing a report on the defects, the machine tool is dismantled into units and then each of them is sent to "its" section.

This year the plant reached its rated capacity, the volume of repairs amounted to 2,050,000 rubles.

This is the main production direction of the plant. The second direction is the production of spare parts for respective machine tools. So far, their list includes 250 items. It is planned to increase the volume to an amount of 5,600,000 rubles.

Another important problem is starting NC machine tools, their adjustment, servicing and out-of-town repairs. But to talk only of repairs means that not everything has been said about the plant.

Its profile is more complicated. The Daugavpils workers modernize machine tools of old systems, converting them to NC. This year, for example, such changes are being made on machine tools of the REZ [Riga Machinebuilding Plant]. Leading specialists are already thinking about robots.

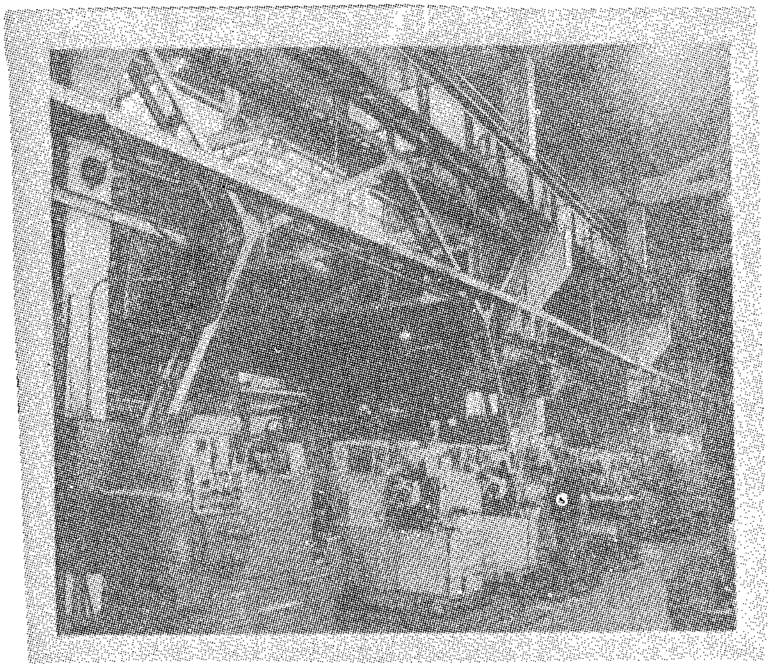


Fig. 1. Section of semiautomatic machine tools for cutting pinions

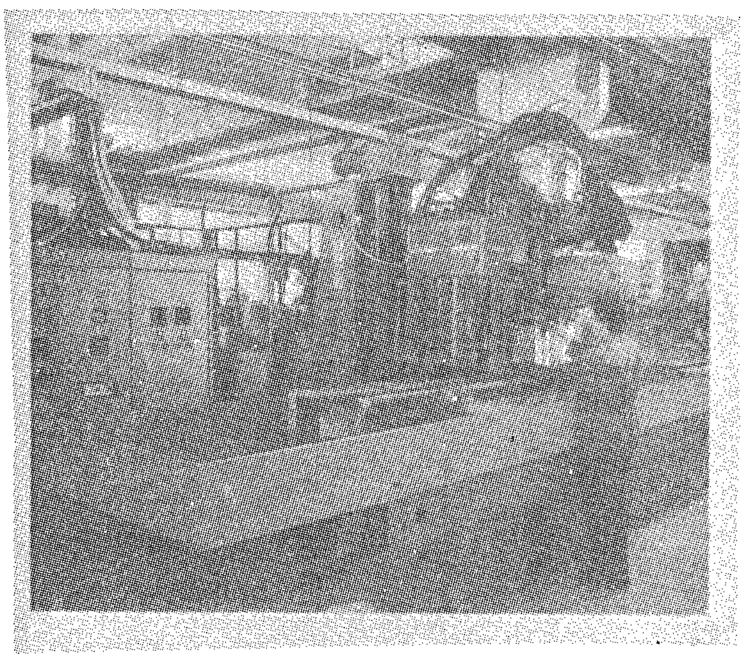


Fig. 2. High-frequency installation for hardening bedplate guides

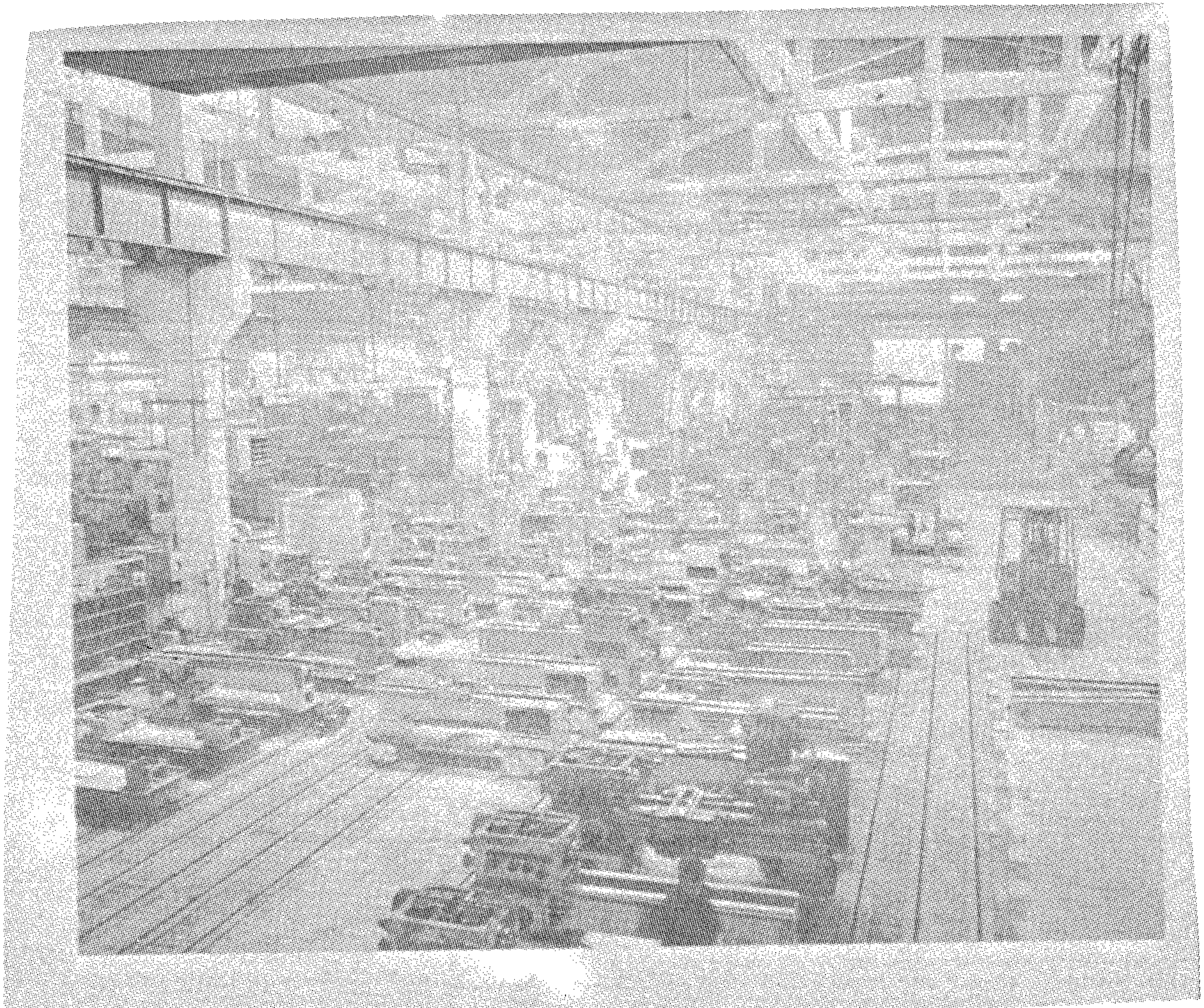


Fig. 3. Section for general assembly of machine tools

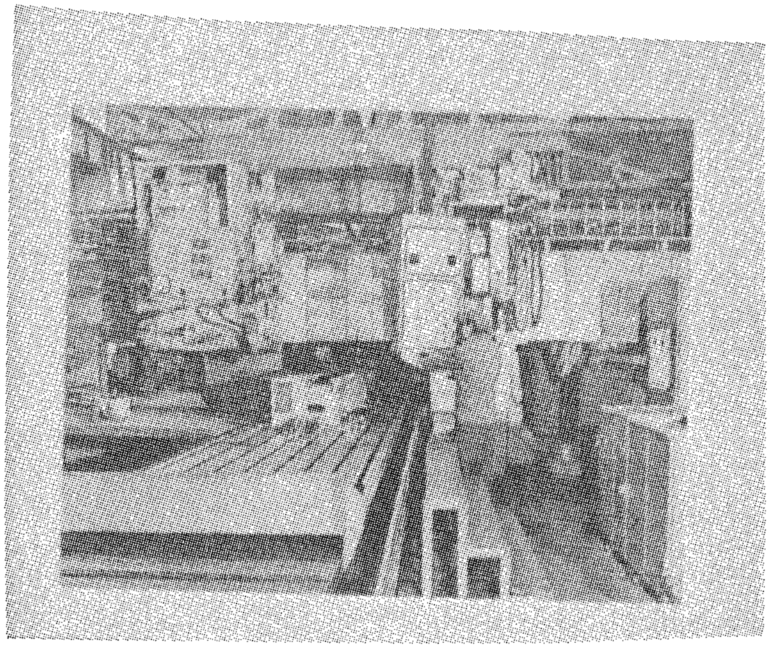


Fig. 4. Face-grinding machine tool for machining bedplates up to 6 meters long

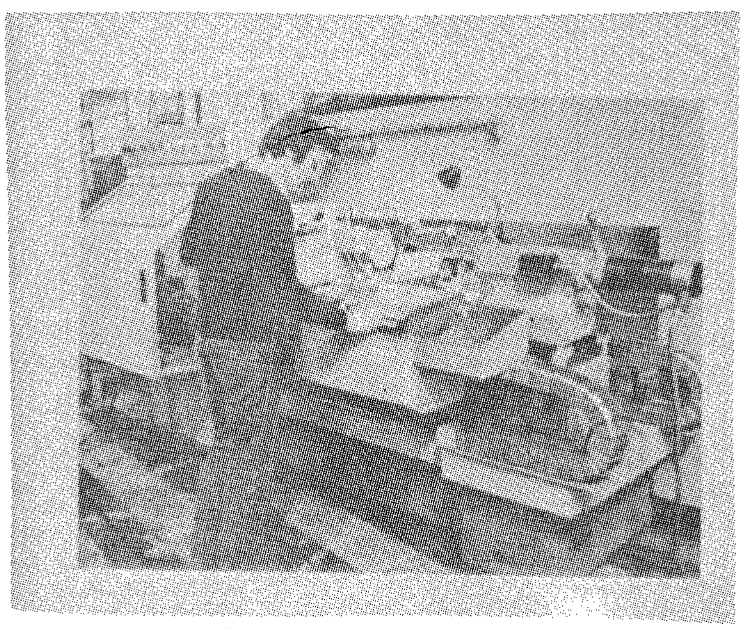


Fig. 5. Lathe with NC which makes it possible to correct the program at any stage of work

Private automobile owners will probably be especially interested to know that soon a simple, light and original device will appear in stores for tire repairs. It was developed by the plant designers, taking into account consumer demand.

Among about 10 enterprises of a similar nature in the country, the Daugavpils Machine Tool Repair Plant is considered the most expert: there are no complaints about the renovated equipment. The initial mistrust has disappeared; therefore, the enterprise receives more and more equipment that requires repairs and modernization. However, the plant still has much to do to expand its product list.

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CSO: 1823/290

BRIEFS

PISTON RING MACHINING -- The collective of the Gomel' Machine Tool Building Plant imeni S. M. Kirov mastered the output of a new semiautomatic machine tool, designed for simultaneous machining of outer and inner surfaces of piston rings. It surpasses the productivity of its predecessor that machined each side of the ring separately. The State Certification Commission awarded the innovation the Emblem of Quality. The first lot of the new semiautomatic machines was sent to the Stavropol' Piston Rings Plant. [By F. Zaytslev] [Text] [Minsk SOVETSKAYA BELORUSSIYA in Russian 28 Mar 84 p 2] 2291

NC TURNING CENTER -- Novosibirsk -- The collective of the Novosibirsk Machine Tool Building Plant imeni 16th party congress began mastering an NC multi-operational machine tool which can more correctly be called turning centers since they can do turning, drilling and milling work. After passing through such a machine, complicated parts do not require further machining. [By V. Okladnaya] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 29 Apr 84 p 2] 2291

CSO: 1823/284

UNIQUE UNMANNED PLASMA CUTTER MODULE DEVELOPED FOR FMS

Leningrad LENINGRADSKAYA PRAVDA in Russian 6 Jun 84 p 1

[Article by engineer A. Malkin, "Without an Operator"]

[Text] Recently a module for the flexible automatic production of flat parts of ships' hulls passed tests successfully at the experimental section of the "Ritm" Association. Without the participation of an operator "Kristall" plasma cutting machines cut out from steel sheets parts of various configurations and dimensions, substantiating thereby the correctness of the ideas put in by the enterprise specialists in the arrangement of the module, that was now implemented in practice.

This event signifies a new stage in the automation of the body machining section in each shipbuilding plant. In spite of the fact that "Kristall" machines have already been used here for not the first time, cutting parts is a fairly difficult operation. The labor is monotonous, gas pollution is high -- all this makes the trade of the operator unattractive and not only in shipbuilding.

To take a step toward unmanned technology, to find a possibility to utilize equipment in various sectors of industry -- this is the problem the members of the comprehensive brigade, headed by Yu. S. Titkov, posed for themselves. Precisely with this organizational measure, the formation of a creative brigade collective of various trade specialists worked on the start of the module at the "Ritm" association. The following heads of sections and rank-and-file engineers joined the brigade: L. M. Gugelev, and N. D. Zheltobryukh, O. B. Orkin and B. I. Serpov, V. A. Sinitskiy, V. K. Uspenskiy, V. A. Chistyakov and others. It was possible to solve complicated problems of developing software, typical algorithms, programing and procurement for the module in a short time. Only six months have passed from the day the brigade was organized and the network schedule was prepared and here -- tests.

In the laboratory where the type SM-4 computer is located, nothing reminds one that preparation is going on to cut steel sheets into parts for the ship's hulls. A tape prepared by the programer is inserted in the read-out device. The cutting code of the chart for the entire sheet is recorded on the tape, or the task for the machine for the shift. The computer issues instructions to the "Kristall" machine, the plasma flame flares up and the fire cutter draws parts of various configurations one after another.

"This module was made up basically of standard domestic equipment and there is nothing like it in world shipbuilding," stated I. P. Lifant'yev, chief of the computer laboratory of the "Ritm" Association. "It uses typical mathematical programs. So far, one computer control does the work of two plasma cutting machines although it is "trained" to control 16. All this makes it possible to use the module without any readjustment at any shipbuilding enterprise. A small readjustment can make the module work at other production facilities, making it possible to cut parts not only from steel, but also from aluminum alloys. In the very near future the technological preparation for plasma cutting will be done by large computers using terminals installed at design bureaus where new ships are designed." The socialist obligations of the association's collective called for completing this work only at the end of the year. The concentrated efforts of the best scientific and engineering forces, finding possibilities to accelerate the entire cycle of developing the new equipment, were able to implement an important point of their obligation in the enterprise. To a large extent, this was helped by cooperation with other scientific collectives, the participation in the module development of the Shipguilding Plant imeni A. A. Zhdanov which was described in the LENINGRADSKAYA PRAVDA in January of this year. And while that first step confirmed the possibility of using series produced plasma cutting machines in the module, now two moreimportant principles are being realized: group control of types "Kristall" and "Granat" machines, as well as a typical structure of building the entire complex for sector enterprises.

At present, the "Ritm" specialists are preparing the unique module to ship it to Vyborg Shipbuilding Plant. Here a comprehensive brigade of the association, in creative cooperation with the plant collective, will begin to introduce components in unmanned technology at the enterprise.

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CSO: 1823/293

OTHER METALWORKING EQUIPMENT

BRIEFS

NOVEL METAL RECYCLING UNIT -- Machinebuilders of the Minsk Tool Building Association imeni S. M. Kirov convert a worn tool into a new one in place. The simple and economical method of remelting small portions of high alloy steels was proposed by production innovators of the enterprise and scientists of the Electric Welding Institute imeni Ye. O. Paton. A small electrical device that they introduced is in the operating principle something midway between a steel-melting furnace and a welding device; it melts the metal so rapidly and so well that it does not have time to lose its initial properties and, therefore, does not require strengthening additives. An intermediate product is formed simultaneously from which, without special work, a tool can be obtained that is of the same quality as the previous one. [By BELTA] [Text] [Minsk SOVETSKAYA BELORUSSIYA in Russian 29 May 84 p 2] 2291

ELECTRO-CHEMICAL MACHINING CLASS -- A scientific-practical seminar "Technology and equipment for manufacturing electrodes for electrophysical and electrochemical machining methods" was held at the "Armstanok" Association. Specialists of leading enterprises in the automobile industry in the country participated. Reports were made by staff members of the association, G. Nalyan, candidate of technical sciences, Yu. Arutyunyan, G. Kandayan and others. The seminar participants became acquainted with new developments on the Armenian machine tool builders which make it possible to mechanize labor-intensive fitters' work. [By M. Gasangalyan] [Text] [Yerevan KOMMUNIST in Russian 15 May 84 p 2] 2291

CSO: 1823/287

BRIEFS

AUTOMATED GRAPHITE ELECTRODE PRODUCTION--Ryazan--500,000 rubles: this is the savings from utilizing in the country's economy just one automatic line, which was designed and produced at the Ryazan Machine Tool Production Association. This line, which comprises several machine tools and an automatic conveyor, is intended for the manufacture of graphite electrodes with a diameter of up to 400 mm and a length of more than 2m. In comparison to previously produced equipment, the new complex is several times more productive: it takes only 2 minutes to produce one electrode. [By Yu. Kazarin] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 29 May 84 p 2] 12731

AUTOMATED COMBINE PRODUCTION--Yegoryevsk (Moscow Oblast) (TASS)--An order from the Taganrog Combine Plant was filled during the pre-May-Day shift by the collective of the Yegoryevsk Komsomolets Machine Tool Plant. Here they produce an automatic line that will be used to make components of the Don-1500 combine. This is Komsomolets' first automatic line. It supplanted at one stroke 12 machine tools that had previously been produced at the enterprise, yet only two people operate it. The Don-1500 combine will be produced from the outset in production bays that are fully equipped with automatic lines. Twenty-three of their type will be made in Yegoryevsk. At a plant near Moscow conversion is under way right now that will enable machine tool builders to shift to the output of processing complexes and, later on, even flexible automatic factories. [Text] [Moscow SOTSIALISTICHESKAY INDUSTRIYA in Russian 22 Apr 84 p 1] 12731

AUTOMATED STARTER MOTOR PRODUCTION--On the eve of May Day a new kind of production was mastered at the Borisov Plant for Motor Vehicle and Tractor Electrical Equipment imeni 60-letiye Velikogo Oktyabrya. Here the output of starter motors was initiated for motor vehicle engines of the Kama Motor Vehicle Plant. The machine tools, conveyor lines and other equipment for producing these units were transferred to the Borisov workers by the Volga autogiant at Togliatti. Starter motors with the trademark of the Borisov machine builders are not only used to equip KamAZ's, they are also used in agriculture. Thanks to the shock work of adjustors, assemblers, testers and inspectors, production of the new product is constantly increasing. Each month the users will receive 15,000 units. [By P. Borodko] [Text] [Minsk SOVETSKAYA BELORUSSIYA in Russian 1 May 84 p 2] 12731

AUTOMATED PRODUCTION BAY--This is what the automated production bay at the Dnepropetrovsk Electric Locomotive Plant looks like. It is supplied with domestic equipment, machine tools with ChPU [numerical control], automated transporting and storage systems controllable via minicomputers, automatic control systems and programming systems. All this has made it possible to raise labor productivity in the production bay by a factor of 2.5. The annual output of 137 separately designated components has been increased by 20 percent. Thirty machine operators have been freed. Working areas have been sharply reduced. The production bay was developed with the collaboration of specialists from Minstankoprom [Ministry of the Machine Tool and Tool Building Industry], Minelektrotekhprom [Ministry of the Electrical Equipment Industry] and RSFSR Minvuz [Ministry of Higher and Secondary Specialized Education]. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 14, Apr 84 p 14] 12731

CSO: 1823/285

ROBOTICS EXPOSITION SHOWS APPLICATIONS IN MACHINE TOOLS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 15 Jun 84 p 2

[Article by V. Lagovskiy, "For Flexible Complexes"]

[Text] "The main advantage of flexible technological complexes is that they can be readjusted rapidly to manufacture new parts, "this is the way to go," said Ye. Belyayev, leading engineer of the Leningrad TsNIIrobototekhnika and of technical cybernetics. "This means that robots in these complexes must be able to handle the most varied articles..."

Our conversation was held at the "Industrial robots and robotized technological complexes" Exposition. "Many scientists, specialists and enterprise managers could be met there. Their heightened interest in the exhibits is easy to explain. Recently the Politburo of the CPSU Central Committee approved measures outlined by the USSR Council of Ministers on accelerating machine-building using the leading technological processes and flexible readjustable complexes. Exactly the equipment that many of them will have to master is here at the exposition."

Among the exponents are the "MP-8" robot developed by specialists of the TsNII RTK [Central Scientific Research Institute of Robot-Technical Complex]. On the table before them lie in disarray prisms, cylinders, cubes and small rods. But the robot selects only trihedral prisms, "tries" them in the hole of the control device and puts them into a box. How can it differentiate one object from another?

"By means of technical sight," replies Ye. Belyayev. "And we were able to develop an "eye" which is not too complicated."

Many articles have many secondary parts, projections, depressions and holes. They are capable of confusing the most perfect electronic 'eye' but these details are no problem. The robot needs to recognize only the shape and position of an article in order to select it from a heap of others and pick it out correctly. Therefore, scientists decided to simplify the problem that originates for the electronic"eye."

A special device like a slide projector casts a bright light on the objects lying on the table. They reflect like clear black shades on its surface. A telecamera easily catches their contours and without any difficulty, a computer recognizes the object and issues an instruction to the robot to "take" or not "take" the object. If it is take -- that's it. The robot's "claw", having assumed the proper position beforehand, moves to the object.

The "MPUS-10" robot has other problems: it demonstrates the possibilities of universal fixtures developed by the specialists of the Khar'kov Special Technological Equipment Plant. Designed on the modular principle, it makes it possible to compose complicated spatial designs with a fixed pitch out of individual components. By using them, robots can service various machine tool groups much more easily.

One of the complexes consists of four lathes on each of which are mounted small manipulators. They take intermediate products from storage devices, insert them into chucks and remove them after machining. The main feature of the complex is that all four machine tools are controlled by one minicomputer. This means that they act on one single program which can be changed easily. Each machine tool executes its own set of operations. But the result is that they produce a finished complicated part. The program is changed and the part will become different.

In creating flexible complexes there rises unavoidably the problem for designers: how to transfer parts from one machine tool to any other? The best solution is by robot-carts.

Specialists of the TsNII RTK are showing such a battery cart at the exposition. Moving along metal strips lying on the floor and riding to a base simulating a machine tool, the manipulator removes the heavy part from it and takes it "aboard." Then, having turned, it begins moving, "docks" at the "warehouse" where the manipulator unloads his "burden."

"We also want to equip it with technical sight," said Ye. Belyayev at the end of our conversation. "Then our cart can be used in flexible complexes with the widest set of machined parts..."

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CSO: 1823/294

EXTENSIVE UNDERUTILIZATION OF UNWANTED ROBOTS REPORTED

Moscow LITERATURNAYA GAZETA in Russian No 17, 25 Apr 84 p 12

[Article by professor D. Palterovich, "Work for a Robot"]

[Text] Recently prominent scientists and specialists in the area of robotics spoke with our correspondent on prospects and problems of robot development in our country (No 7, February 15 of this year). Many readers joined in the discussion on this vital subject. Today, professor D. Palterovich, senior staff member of the Economics Institute of the USSR Academy of Sciences, doctor of economic sciences states his considerations on the economic aspects of robotization

We will ask a simple question: what will the 30,000 automatic manipulators which it is planned to manufacture in 1985 cost the national economy of the country? Regrettably statistics cannot give the answer. It puts simple manipulators costing several thousand rubles and the most complicated robot equipment systems with NC, each of which costs tens of thousands of rubles, in a common kettle. Moreover, industrial robots must be equipped with fixtures and accessories and, coupled with the rest of the equipment which, as estimated by specialists, doubles their cost, on the average. If to this are added the costs of research, development and training personnel, it adds up to a very impressive sum. According to the most modest calculations, it may exceed a billion rubles in the five-year plan period.

What will be the cost of freeing each worker when robots are introduced? For example, at the Minstankoprom [Ministry of Machine Tool and Tool Building Industry] plants, according to a statistical report for 1982, it cost over 19,000 rubles. When automation is not implemented comprehensively, there may not be any real saving: two-three workers were freed, but a programer, adjuster and an electronics specialist added.

What, then, a surprised reader may ask, does the writer suggest? Renounce automation? Direct money and resources which are always limited to satisfying requirements in "small scale equipment?" Be on the other side of the main road of scientific technological progress along which all industrial countries are rushing?

Of course not! Production now reaches the point where its further successful development without broad automation becomes simply impossible. There are no other ways to increase output because the influx of new labor resources is extremely limited. There are no other ways to free man from heavy, monotonous or unhealthy labor. This writer only calls for a realistic evaluation of the possibilities, shapes and directions of automation at each stage of its development.

As is well known, anything new is born in suffering and contradictions. Nor did the robots avoid them. This is even reflected in newspaper headlines. Their "palette" -- goes from rosy optimism to black pessimism.

The realization of a dream, "Robots are asking for shops," "On the robot's shoulders," "Robots today and tomorrow," "A sector is born" ... Yes, there is a basis for optimism at a number of enterprises. In shops of the Petrodvortsov Watch Plant, assembly robots and other manipulators save the labor of many hundreds of workers, In the "Leningradskiy Electromechanical Plant" all 28 presses in the stamping section are serviced by automatic manipulators. At the Kovrovsk Mechanical Plant a number of robotized lines and sections, equppped with 55 manipulators were created, freeing 70 machine tool operators and saving 250,000 rubles per year.

But here are other headlines: "Where robots stumbled," "Robots are idle," "Give robots a hand" ... What is behind them? Sad histories. One plant acquired a pair of robots for prestige. Another acquired "steel helpers" to implement a plan sent them by the ministry. The third enterprise needed a scarce press that could only be obtained in a set with a robot: the press was installed, but the robot found itself in the pile ... These histories appeared in the pages of three central newspapers in one year. This was the same year of 1983 when the production of NC automatic manipulators (industrial robots) doubled to 10,070 units.

Perhaps we are talking about single cases? If only it were so! Here are summaries of daily statistical investigations made in May 1982 at machinebuilding enterprises: almost a quarter of the machining equipment with industrial robots stood idle. If manipulators, not installed and not in a set with machine tools, were taken into account, then the share of fully idle robots would be found to be much greater. There are also many "half idle" manipulators that are idle for one and sometimes two shifts.

For robots and flexible production systems to become efficient, it is necessary to observe a number of conditions. We will name the most important ones.

First, it is necessary to determine correctly the areas of application and distribute various types of the "smart machines" in these areas.

Second, it is necessary to achieve high quality and reliability of the manipulators.

Third, it should be categorically forbidden to supply "bare" robots without a set of equipment -- clamps, transport and storage systems and other necessary devices.

The best version is to supply robots already assembled with the basic equipment.

Fourth, obviously one cannot dispense with such economic norms as the time in which the robot will pay for itself, or the ratio between the cost of the robot and the annual wages of a worker. The lower this ratio the faster the robot pays for itself.

Fifth, (in order, but not in importance), it should be kept in mind that the preparation of enterprises for using robots is no less important than their manufacture. Even the most perfect robots would be dead weight if one did not know how to handle them: how to assemble, adjust, service, repair, program and operate them...

The list of conditions could be extended. One thing is clear: it is hardly necessary to chase after the number of robots. The success of robotization should be evaluated by how many of the smart machines "work" efficiently at working positions and how many workers they actually replace.

Without doubt, a most important condition for wide automation is personnel: professionals of the highest class are necessary! Primitive production methods are intolerable here. The low effectiveness of robotization is due, in my opinion, to the fact that in many cases robotization is done entirely too spontaneously without the necessary specialization. Each sector and also frequently individual enterprises begin the creation of their own departments, design their own manipulator models, expending effort, money and time (frequently on reinventing the bicycle). But where to get specialists for tens of hundreds of new departments? Sever 1 days ago I read the following advertisement on a pole at the bus stop: "Urgent! A newly organized scientific research department of a Scientific Research Institute requires specialists of various kinds in the area of robot equipment..." It listed the same kinds of specialists whose training, as noted in the LITERATURNAYA GAZETA, is practically only beginning.

The problem of specialized robot building is to implement a single technical policy in its area to cut, so to speak, robot equipment to the "shape" of the consumer and carry direct responsibility for the efficiency of machine utilization. Here it should be kept in mind: robots do not like solitude... They are inefficient even on the scale of a "department." Only an entire "platoon" of them can justify the creation of special services of flexible automation at enterprises.

Thus, in the very near future there must appear a sector which will supply robot equipment at least to several enterprises, and create the kind of beacons that will show others the way to the goal -- the wide introduction of comprehensive automation.

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CSO: 1823/292

ROBOTICS

BRIEFS

ROBOT PRODUCTION -- Orel -- The Orlov "Promprribor Production Association built a proving ground for robotization production. Here industrial robots, not quite prepared for plant life and manufactured by various enterprises,are received. Specialists assemble, adjust and break in these electronic helpers, and train them to do monotonous and heavy work, harmful to man. Here are also standard model robots which "novices" can use as examples, mastering their programs. Only after a full course of "training" are they sent to plant shops. Already 170 robot equipment complexes and automatic manipulators are at work in the preparatory and assembly shops of the "Promprribor" Association, doing a considerable part of the welding, plating and assembly operations. [By K. Volodin] [Text] [Moscow IZVESTIYA in Russian 5 May 84 p 2] 2291

ROBOTIZED COLD STAMPING -- Rostov-on-Don -- The Rostov Scientific Research Institute of Machinebuilding Technology developed a robotized section for cold stamping agricultural machine parts. Five presses, five robots and auxiliary technological equipment do all the basic and auxiliary operations automatically. This development of the institute was introduced into production. Robotized sections were installed in the "Pyatigorsksel'mash" and "Nezhinsel'mash" plants. They made it possible to raise the productivity of labor by 30 percent. [By Zh. Linskaya] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 24 May 84 p 2] 2291

ROBOTIZED PRESS OPERATION -- Vil'nyus -- An automatic press shop, equipped with industrial-manipulator-robots, was put into operation at the Plastic Products Plant. Yesterday it began making products. The first stage of changing the enterprise to unmanned technology has bee completed. Other leading emterprises in the republic are changing over to unmanned technology. As announced by the Lithuanian SSR Gosplan, there are now in operation over a hundred comprehensively automated shops and sections; five thousand auxiliary workers and handymen became operators and adjusters after their skills were increased. Since the start of the five-year plan period, four-fifths of the production increase in the industry of the republic were obtained by increasing the productivity of labor. [By TASS] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 6 Jun 84 p 2] 2291

CSO: 1823/286

UDC 331.875.4:65:66

DATA GATHERING, AUTOMATED TECHNOLOGICAL PROCESSING REVIEWED

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 3, Mar 84 pp 27-29

[Article by B. M. Ostrovskiy, candidate of technical sciences and M. L. Leykand, engineer, "Organization of Data Gathering and Processing in the ASUTP of Preparatory Production"]

[Text] Automated systems for enterprise control (ASUP) and automated systems for technological process control (ASUTP) have developed widely in all sectors of industrial production. However, due to the various natures of the problems being solved in the ASUP and the ASUTP, they developed independently of each other; in each system its own idea of building the methodological, organizational and technical base was developed. The differentiated approach to solving automatic control problems even at the stage of the technical design of the system facilitated the deepening differences in building ASUP and ASUTP. As a result, there is no single comprehensive approach to the control of an enterprise and its subdivisions.

One of the most urgent problems in increasing the efficiency of planning and control at an enterprise is the compatability between ASUP and ASUTP.

The idea of designing distributed multilevel computer networks consisting of high capacity computers that solve ASUP problems at the higher level, and several small computers for solving technological process control problems at the lower level was adopted widely.

The small computer systems used at present have a fairly large direct-access memory, with the possibility of connecting a wide set of auxiliary memory units, devices for communications with a technological object (USO) and peripheral equipment for various purposes, as well as the possibility of working with many users in the multiprogram mode. All this makes it possible to solve problems of controlling production and technological equipment at relatively small enterprises or subdivisions with one computer set.

Solving the problem of compatability between ASUP and ASUTP requires a single approach to designing the system, full intercorrelation between the problems, unity of technical, informational, methodological bases and software.

The Kiev branch of the Ukraine "Tyazhpromielektroproyekt" State Design Institute completed the development of a project for an automated system for controlling technological processes for a boiler room preparatory complex (ASUTP-KZK) for the "Uralkhimmash" Association.

The "Uralkhimmash" Plant is an enterprise with a unique nature of production that manufactures special design equipment for chemical and petroleum-refining enterprises of the country. The products of the plant are distinguished by their metal content, with a considerable volume of production being preparatory operations for laying out metal.

At present, the technological part of the design is finished and construction has begun of one of the largest specialized preparatory complexes in the country.

It is planned to locate, in the KZK, RR siding tracks for unloading incoming metal, a metal warehouse, sections for quality control of sheets, lines for sheet preparation (truing, cleaning, prime coating, polishing, etc.), a warehouse, technological lines for branding metal, thermal, gas, oxygen and machine cutting, sections for machining intermediate products and a warehouse for the finished products of the complex.

The volume of machined metal and manufactured parts of the plant is 5 to 50 cars of metal per day, up to 1.5 million manufactured parts per year and 100 different kinds and type-sizes of metal sheets. The annual sales volume is 21 million rubles.

The technological operations for cutting metal are done on types "Kristall" or "Strela" machine tools with NC, as well as on imported equipment.

The total length of the technological route for manufacturing parts is up to 1km long. The extensive use of metal for parts and the considerable number of technological operations makes planning and accounting for the work of intermediate product-production difficult.

It should be noted that unproductive losses in working time are basically spent in searching for materials and parts. According to the data of the enterprise, they make up 4.2 percent of the working time, while metal losses are up to 2 percent of the total volume. With such production scales in the preparatory building, the indicated losses are fairly significant.

At present, over 50 men are occupied in accounting for the condition of production. The volume of work done for other subdivisions of the plant in various subsystems, as well as the complexity of document turnover with a centralized system for preparing data for a large enterprise do not make for efficient accounting and planning, although an ASUP [Automated system for enterprise control] using the YeS computers is functioning in the enterprise.

The reasons accounted for the necessity of developing an ASUTP for the KZK of the plant organizationally and technologically tied to the ASUP of the enterprise.

In developing the system, the basic demands were defined -- technological and organizational.

The technological demands on the ASUTP are:

convenience of data input into the system, reduction to a possible minimum of document turnover and time for fixing the condition of production;

simplification of the organization process for obtaining data;

possibility of the efficient receipt of data on requests about the progress of production, location of metal and parts;

necessity of insuring the reliability of the system when devices of the technical complex fail;

communications between the complex control system and the automatic control system of the enterprise.

possibility of further development of the functions of the system for connecting communications devices with the object for controlling actuators at the finished products of the KZK;

monitoring the introduced data.

When developing ASUTP, a goal was set to realize solutions for the efficient utilization and economy of material resources, especially metal, having put in order the accounting and planning for metal consumption, reduce unproductive losses of metal and labor time, raise the productivity of accounting-planning work without increasing the number of workers.

Organizational demands of ASUTP:

substantiated daily-shift planning of the work of each subdivision of the complex according to the results of the work in the preceding operations;

efficient report on the condition of production by introducing the least possible volume of data;

efficient presentation of data on the current production condition and stocks in warehouses conveneint for consumers on requests;

development of report documentation on complex documentation as established for the enterprise.

These requirements are implemented as follows. Eight report posts are established for producing data on the progress of the technological process. A type VTA-2000/13 alpha-numeric display and a DZM-180 or DARO-1156 sequential printer are available at each post. An IRPS interface printer is connected to a video terminal; the video terminal is connected to the UVK [control computer complex] based on the SM-4 computer.

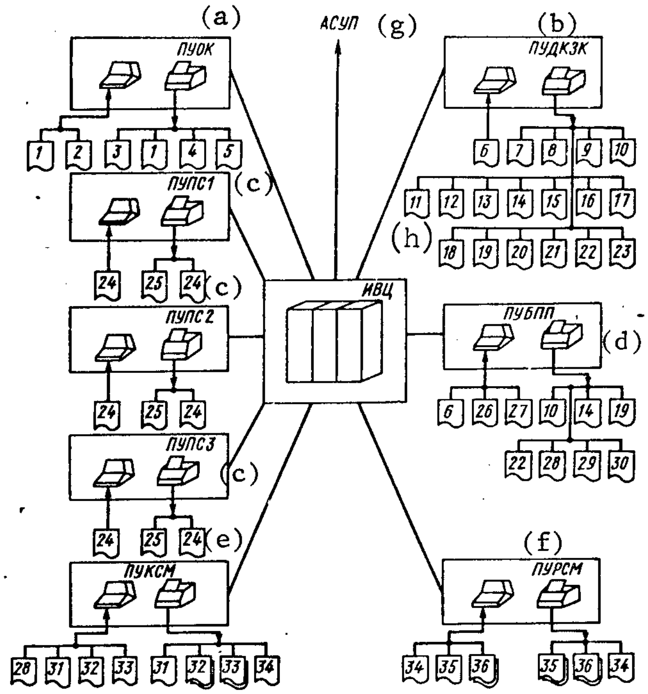

Fig. 1. Data flows in the ASTPU-KZK:

a -- PUOK -- record post of procurement department; b -- PUDKZK -- record post of dispatcher service of the boiler-preparation complex; c -- PUPSI-PUPS3 -- record posts of positions for sorting parts received from the cutting line; d -- PUBPP -- record post of the bureau for program preparation; e -- PUKSM -- record post for shell metal warehouse; f -- PURSM -- record post for disbursement metal warehouse; g -- ASUP; h -- IVTs; 1 -- daily-shift task for part distribution; 2 -- invoice; 3 -- report on free pallets; 4 -- report on availability of parts in the procurement department; 5 -- report on parts received in the procurement department; 6 -- requests; 7 -- daily-shift task on sorting metal for incoming quality control; 8 -- report on metal that passed incoming quality control; 9 -- report on nonfulfillment of daily-shift task for sorting metal for incoming quality control; 10 -- report on availability of metal for sorting in the shell warehouse; 11 -- report on closing the set; 12 -- report on fulfilling the commercial plan for the shop; 13 -- report on data about nonfulfillment of the schedule for intershop cooperation; 14 -- report on metal sent to preparatory shop; 15 -- report on nonfulfillment of daily-shift task by the primary preparation of metal department; 16 -- report on the nonfulfillment of the daily-shift task on branding sheet parts; on distributing metal to cutting lines; 17 -- calculation of daily-shift task on cutting rolls; 18 -- report of unfulfillment of daily-shift task on sorting metal; 19 -- report on laid out metal; 20 -- report on nonfulfillment of daily-shift task on distributing parts; 21 -- report on distributing parts from the procurement department; 22 -- report on metal deficit; 23 -- report on nonfulfillment of daily-shift task on sorting metal for incoming quality control; 24 -- daily-shift task on sorting parts; 25 -- accompanying list; 26 -- task for start-up of

parts in the KZK; 28 -- report on metal received in the boiler shell warehouse; 29 -- report on metal received in the metal distributing warehouse; 30 -- report on the availability of branded sheets in the metal distributing warehouse; 31 -- daily-shift task for sorting metal for incoming control; 32 -- daily-shift task for sorting metal for incoming quality control; 34 -- daily-shift task for the primary preparation of metal department; 35 -- daily-shift task for branding sheet parts; 36 -- daily-shift task for cutting metal.

The operator at each of the report posts inserts new data as it is received, by operating the display keyboard. In doing that, he indicates his own code and the message code. The document "cap" with limiters of inserted requisites are read out on the screen according to the message code. Each message line is checked by a monitoring program and is inserted into the data file, corresponding to the message code. Incorrect lines are not inserted into the data file; a message is issued about the error. A "hard" copy of the input data is read out on the printer of the report post for monitoring the input data.

As initial data from the report posts information is inserted on metal received at the KZK warehouse and on the program for the output of parts and intermediate products for the planned period with instructions for the technological routing; on the distribution of parts from the procurement department warehouse, as well as data on the nonfulfillment of the daily budgeted tasks at production sections. The arrangement of data flows in the ASUTP is shown in Fig. 1.

Report posts are located directly in the production building; their equipment is installed in sets at operator stations (KOP). The stations are enclosed structures with aluminum wall panels with windows which provide confortable working conditions for the operator working in a building with a high noise level. Ventilation and communications networks in the KOP are connected to the equipment installed in them.

Data received from the report posts is processed on a type SM-4 computer by programs for solving the application problems of the system. Algorithms were developed for 35 problems that insure the functioning of the system and record changes occurring in the production process.

Problems are solved in real time on the initiative of many users under control of the operational real time system (OSRV).

ASUTP software includes application programs for data processing; insertion of initial data by report point, and auxiliary and service programs.

The application programs for data processing implement the following problems:

record of metal in the warehouse and of intermediate products and parts in the metal distribution warehouse, as well as in the procurement department (5 problems);

fulfillment of daily-shift tasks by subdivisions (7 problems);

calculation by subdivisions of tasks of daily shifts (10 problems);

preparation of reports on the activity of preparatory production during the planned period (3 problems). Application problems are solved under control of the dispatcher program. The subsystem for inserting and monitoring initial data includes programs for controlling the data gathering process, insertion of data from report posts and processing requests.

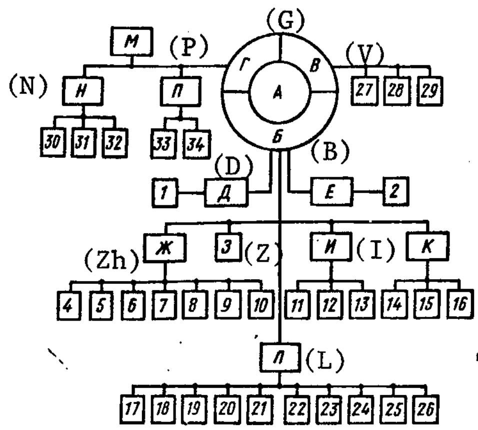

Fig. 2. Structure of the ASUTP-KZK software: A -- operational real time system OSRV; Z -- control program for subsystem 2 "Dispatcher ASUTP-KZK"; B -- applied software; V -- program for input and monitoring of initial data; 27 -- processing requests; 28 -- data input from report posts; 29 -- control of gathering data process in the ASUTP-KZK; G -- auxiliary and service programs; D -- problem of reporting on metal in distributing warehouse; 1 -- report on fulfilling tasks on branding metal; E -- problems on reporting parts and intermediate products in the procurement department; 2 -- report on parts in procurement department; Zh -- problems on fulfilling daily-shift tasks; 4 -- report on fulfilling tasks on roll cutting; 5 -- report on fulfilling daily-shift task on sorting metal; 6 -- report on fulfilling task on incoming quality control; 7 -- report on fulfilling task by primary metal preparation department; 8 -- report on fulfilling tasks on issuing metal to the cutting lines; 9 -- report on fulfilling the daily-shift task on cutting lines; 10 -- report on fulfilling task on issuing parts; I -- report on metal in shell warehouse; 11 -- report on metal arrival at the KSM; 12 -- report on availability of metal at boiler-shell metal warehouse; 13 -- report on metal deficit; K -- problems of forming reports in KZK for plan period; 14 -- forming KZK report on set closing; 15 -- forming a report on fulfilling commercial plan for shop; 16 -- preparing information on fulfilling intershop cooperation schedule; L -- problems of calculating daily-shift tasks of KZK subdivisions; 18 -- forming the "Group start-up" data dile; 19 -- task on metal start-up in KZK; 20 -- calculation of daily-shift task for sorting metal in shell metal warehouse;

21 -- calculation of daily-shift task on outgoing quality control; 22 -- calculation of daily-shift task of primary metal preparation department; 23 -- calculation of daily-shift task on branding metal; 24 -- calculation of daily-shift task of cutting lines; 25 -- calculation of daily-shift task on sorting positions; 26 -- calculation of daily-shift task on issuing parts to KZK; M -- problems of correcting data files; N -- problems of working with data files; 30 -- servicing file generations; 31 -- storage and restoration of reserve copies; 32 -- restoration of system condition after malfunction; P -- problems of forming norm-reference files; 33 -- forming a file of parts names; 34 -- forming a file of leading operations.

Auxiliary and service programs implement problems in working with the data file, forming and correcting data files.

The software structure is shown in Fig. 2.

Data for solving system planning problems is received from the ASUP of the plant, using the type YeS computer. Results of the solutions of report problems are transferred from the ASUTP of the complex to the ASUP data file by the enterprise.

To insert data, printed-out solution results of plan programs are used, supplemented by information on task fulfillment. To reduce the volume of data inserted from report posts, only information on the nonfulfillment parts of tasks with the statement of causes is used. Tasks fulfilled on each operation are included in the plan for following operations by processing programs; for the unfulfilled operations messages are sent to take measures to eliminate the causes.

A sheet of metal is used as a unit for making the report. Each sheet is marked by a number and it is followed by the system along the entire technological route -- from the issue of the metal from the warehouse to obtaining the finished part. In its turn, the number of the program for the layout corresponds to each sheet number. The movement of the part is tracked by the system from the moment it is received from the cutting lines to its distribution from the finished product shops.

The results of the solution of all indicated problems are printed at report posts, territorially near the data users (see Fig. 1). Printing time is especially allotted for this purpose, i.e., when there are no incoming messages. Moreover, information on users requests is brought out on the video terminal or printed.

As a result of solving ASUTP problems, the following are printed out at the report posts: daily-shift tasks of subdivisions in the complex; reports on availability of materials, intermediate products and parts in warehouses; messages on nonfulfillment of tasks in the complex during the planned period.

In all, there function in the system four documents, prepared manually, 10 documents printed by the system for the following data to be inserted:

26 documents may be given out on request by users in answer to an inquiry.

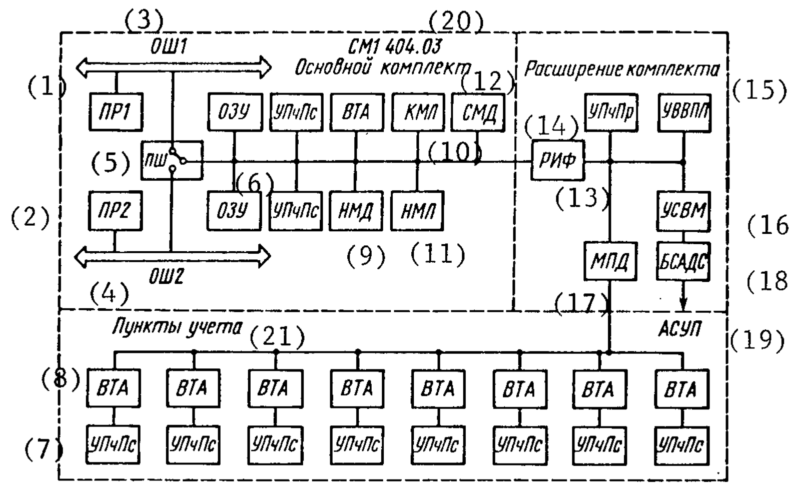

Fig. 3. Structure of a complex of technical means of ASUTP-KZK:

1, 2 -- PR1, PR2 SM1404.03 computer processors; 3,4 -- OSh1, OSh2 common buses; 5 -- PSh bus switch; 6 -- OZU -- direct access memory; 7 -- UPchPs sequential printer; 8 -- VTA alpha-numeric video terminal; 9 -- NMD magnetic disk memory; 10 -- KML magnetic tape cassette memory; 11 -- NML magnetic tape memory; 12 -- SMD packet of replaceable magnetic disks; 13 -- RIF interface expander; 14 -- parallel type printer; 15 -- UVVPL device for data input-output on punched tape; 16 -- USVM device for linking computers; 17 -- MPD multiplexer for transmitting data; 18 -- BSADS unit for linking adaptors of remote communications; 19 -- ASUP automated system for enterprise control; 20 -- SM1404.03 basic set; 21 -- report posts.

Data received from the report posts are processed in the UVK on the type SM-4 computer. The structure of the technical devices complex is shown in Fig. 3. The UVK consists of a two-processor set with a 128-word OZU of the semiconductor type, a PSh, two ATsPU of the sequential type, a type YeS-5061 29 megabyte NMD and a type IZOT NML. The set also includes devices for punched tape input-output data for parallel printing of data over communications channels.

A type SM-8514 MPD data transmission multiplexer was selected for communications with the report points. It provides connections to 12 communications channels through the IRPS interface device for connecting to terminals without using modems.

Type A711 USVM is used to connect the system to the ASUP. Since it cannot provide communications to remote computers, BSADS units are connected to the communications channels. The maximum distance between the report posts and the UVK is 300 meters and between the UVK and the type YeS computers 2 kilometers.

A real time system (OSRV) was chosen for a control system, as most suitable for the posed requirements and provides multipanel, multiproblem work in the operational mode. In selecting the control system, possibilities were taken into account of producing an instruction file in the OSRV for the control program, as well as the availability of system programs for working with the files, storing and copying the files from a device to a device.

The assumed saving from introducing the system is 13,268,000 rubles and pays for itself in 2.37 years. Introduction of the ASUTP-KZK at the "Uralkhimmash" Plant provides the personnel with full, authentic and timely information on the progress of production, on producing optimal production plans, which will facilitate increasing the output and improving its quality to a considerable extent.

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CSO: 1823/185

UDC 002.5:65.011.565

CONFLICT RESOLUTION SCHEME FOR SUBSYSTEMS OF CAM

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 3, Mar 84 pp 31-33

[Article by A. A. Kiselev, engineer, and R. V. Chernov, candidate technical sciences; "Special Features of a Multilevel Hierarchy of Controlling an Enterprise with ASUP"]

[Text] To control an industrial enterprise efficiently, it is necessary to coordinate production control within the ASU [Automatic system of control] framework. The urgency in solving this problem is dictated by a number of difficulties arising in controlling the enterprise.

Many enterprise ASU do not envision and, therefore, do not realize fully the processes for adapting decisions, because basically they lack unique models of local loops for controlling functions.

A unique model of the local control loop is a set of problems that takes into account the actual condition of the object being controlled, the evaluation and identification of the problem situation, an analysis of this situation, the adoption of corresponding decisions and directing them to the object of control.

It was established that within the loops, there are so-called logic gaps, i.e., in analyzing solution results of reported problems as problematic situation is observed but no decisions are adopted on it. In the best case, they are adopted on the basis of the results of solving optimization problems, but even in this case no analysis is made of the problematic situation.

Sometimes delayed decisions on problematic situations are adopted after they are identified. A functional manager is involved in identifying problem situations of control, their analysis and in adopting a decision. As is well known, on the basis of the received information and personal experience, he must adopt independently a decision in each specific situation and act on controlling the functional subsystem. However, there is no guarantee that all adopted decisions are substantiated and correct.

In adopting these or other decisions on individual problems of the functional subsystem, the manager cannot evaluate fully the consequences of the decisions he adopted on other functional subsystems, because, within the framework of modern ASU, he is responsible only for the work of his subdivision. Many decisions adopted by managers are of a local nature, which frequently involves the origination of administrative conflicts. Such are, for example, gaps in junctions between the following functional subsystems: control of material-equipment procurement -- efficient production control; control of management services -- efficient production control; technical preparation for production-control of material-equipment procurement -- efficient production control, etc. In managing an enterprise, the gaps between the functional control loops are usually compensated for by using irrational, structurally undefined data transmission channels. Thus, obviously, coordination is needed between subdivisions of various functional control systems.

To produce such coordination, it is necessary to take into account the special features of multilevel control hierarchy and systematize the basic principles of coordinated hierarchic control of an enterprise under ASU conditions.

At the basis of the multilevel enterprise control system lies a hierarchy of decision adopting processes based, in their turn, on the hierarchic organization of the production systems -- control objects. Such organization of production subsystems makes it necessary to produce also a corresponding organization of functional control subsystems.

As noted above, in the process of control system functioning between subsystems and their components, contradictions may arise between so-called intralevel and horizontal levels, as well as between components in adjacent hierarchic levels within one subsystem, -- intralevel vertical ones.

All production situations that require coordination of decisions for eliminating such conflicts, are called single-level problematic situations, or problematic control situations.

If functional subsystem decisions in a specific problematic control situation are not coordinated at the proper time, conflict grows, involving other levels in the enterprise control system and, as a result, a hierarchy of problematic situations arises. It, in its turn, necessitates the adoption of many local decisions within the functional subsystems. In this case, according to the internal goals of the functional subsystems at the highest control level, local decisions are adopted and they are transmitted to the lower level in the form of directives. Then, at the lower level, local subsystems decisions are adopted taking into account the decisions of the upper level and are transmitted correspondingly to a still lower level. Thus, the hierarchy of problematic situations causes the appearance in the functional control subsystems of the hierarchy of local solutions. It is proposed that all decisions adopted in functional subsystems within the framework of a similar hierarchy of local decisions be called hierarchic local decisions.

However, such a hierarchy of local decisions does not insure the achievement of the common goals of an enterprise. This is possible only when local decisions of various functional subsystems are coordinated. Coordination includes an analysis of the local decisions, the adoption, on its basis, of system decisions on each control level and bringing them to the corresponding levels of the functional subsystems. Therefore, the hierarchy of problematic situations causes the appearance of a hierarchy of system decisions, oriented toward carrying out a coordination of local decisions for functional subsystems at each enterprise control level. Decisions adopted within the framework of system decisions we will call hierarchic system decisions.

In the process of the functioning of the multilevel enterprise control system, all three hierarchy types (problematic situations, local and system decisions) are interrelated by cause and effect relationships, that reflect the structure of the ties between the subsystems and their components in a specific problematic control situation.

A very important in principle question of coordinated hierarchic enterprise control is the one on centralizing and decentralizing decision adoption. If the basic mass of decisions is assigned to the higher level, this raises the degree of centralization; if it is assigned to the lower level -- this raises the degree of decentralization.

In practice, coordinated enterprise control is possible by centralizing the adoption of decisions but, in this case, problematic situations arising at lower levels may also spread to higher levels up to the highest enterprise management (center for adopting decisions), causing duplication of information at various intermediate control levels. Centralization increases information transfer time from the lower levels, that implement the adopted decisions, to higher levels and back, which sometimes leads to the distortion of the information about the object of control and to making incorrect decisions. Therefore, problems originating at any level must be solved in a centralized manner but on the same level.

In this connection, a recommendation can be made to have the control center that adopts decisions closer to the corresponding control level, which is provided by introducing, in each level, components for coordinating solutions that implement the processes of coordinated enterprise control. The components of coordinated solutions interact vertically between themselves and horizontally in each level with the structural components of functional subsystems, forming thereby a mechanism of coordinated hierarchic enterprise control.

However, enterprise control systems are systematically subjected to the effect of external and internal disturbing factors that lead to a change in the condition of the problematic situations and creates a temporary structure of ties between the subsystems and their components for developing and adopting decisions corresponding to the originated goal. In the ASU, enterprises can solve a given problem by including, for a certain time, the necessary structural components of the functional subsystems into the general process of coordinated hierarchic enterprise control (and with their following exclusion from the process).

New problematic situations arise very frequently at enterprises and the structure of the ties between the subsystems and their components also changes frequently. The formation of the enterprise ASU functional structure for a specific problematic situation must occur in the very process of system functioning and is its integral part.

Thus, a multilevel hierarchy of coordinated enterprise control may be considered as a variable, dynamic structure of a multilevel automated control system.

The development of theoretical and practical bases for building an efficient enterprise control hierarchy and efficient mechanisms for developing and coordinating local decisions is one of the most urgent problems.

In considering a multilevel control hierarchy at any existing enterprise, it may be established that it orients basically toward vertical ties. Horizontal ties, although they exist, are utilized inefficiently. Lower hierarchy levels must coordinate with the upper levels specific decisions, while the latter monitor the resources for their implementation to the extent to which they are utilized by the lower levels of the control hierarchy. This weakens the interaction between the horizontal ties. Their basic purpose is in coordinating local decisions between subdivisions of one hierarchic level of control. In other words, in an existing system, vertical ties absorb the horizontal ties almost fully which causes a substitution of a system decision of a given level by local decisions of several levels and, naturally, a substitution of a hierarchy of system decisions by a hierarchy of local decisions.

Therefore, along with existing principles for creating ASUP [CAM-computer aided manufacturing (systems)], the first principle of coordinated hierarchic enterprise control is the system approach in adopting decisions at each level. It is achieved by separating, at each level, corresponding components of decision coordination (ESR) as centers of enterprise control systems, consolidated into a single subsystem for coordinating decisions (PSR), and developing structural and mathematical bases for its functioning.

The second principle is the hierarchic centralization of adopting system decisions. In other words, if, as a result of coordinating local decisions a system decision was not adopted at the given level, then coordination is done at a higher level. As a result, the system decision adopted there is brought down to the lower level.

This principle is insured by the functioning of the hierarchy of system decisions in the subsystem for coordinating decisions with full interrelation with the local decisions hierarchy and problematic situations in the functional control subsystems. The considered principles may be represented graphically in the form of a functional arrangement of subsystems of a multilevel enterprise control system (Fig. 1).

To eliminate logic and temporary loop gaps, it is necessary to take into account a third principle -- the structural closure of control loops. This principle must lie at the basis of the development and functioning of loop models for adopting local decisions and loop models for adopting system decisions in a multilevel hierarchy of enterprise control. It is necessary to exclude doing the work of various stages of one and the same control loop in various subdivisions of control subsystems.

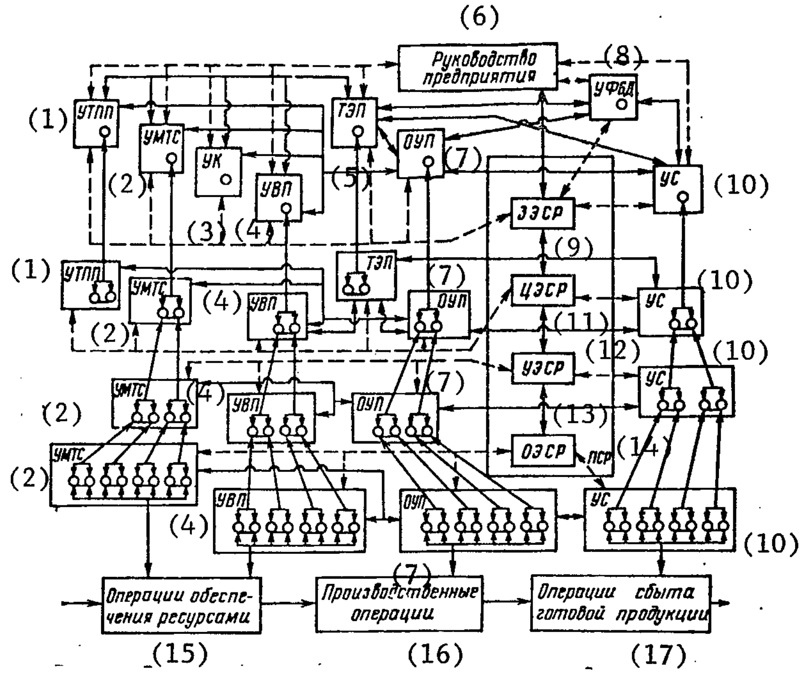

Fig. 1. Arrangement of subsystems of a multilevel enterprise control system:

1. UTPP -- control of technical preparation for production;
2. UMTS -- control of material equipment supply;
3. UK -- personnel control;
4. UVP -- control of auxiliary production;
5. TEP -- technical economic planning;
6. Enterprise management;
7. OUP -- operational enterprise control;
8. UFBD -- financial-accounting activity control;
9. US -- sales control;
10. ZERS -- plant component of coordinating decisions;
11. TsESR -- shop component of coordinating decisions;
12. UESR -- section component of coordinating decisions;
13. OESR -- operational component of coordinating decisions;
14. PSR -- subsystem for coordinating decisions;
15. Operations for procurement of resources;
16. Production operations;
17. Operations for selling finished product.

With the correct utilization of this principle, there is a possibility of building single control models that include problems of taking into account the condition of the object, identifying problematic situations, their analysis and adopting decisions bringing them to the specific object of control. It is possible to ensure realistically the responsibility of the subdivisions and workers for all problems in the control loop, which also increases their responsibility for adopting the decisions.

The principle of the closure of control loops is a constructive development of the functional closure principle of subdivisions in the control apparatus used in developing the ASUP. It is distinguished by the fact that is contains such accurately-definable and practically uniquely identifiable components as the control loop and the problem.

Fig. 2 shows three control loops, each of which is presented in the form of the totality of its component problems.

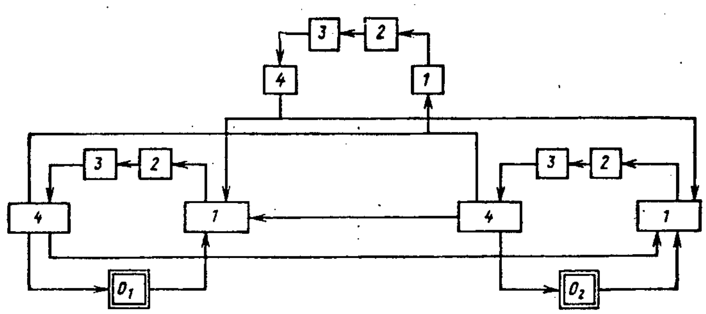

Fig. 2. Arrangement of control loop ties: O_1, O_2 -- control objects;

1. problem of accounting for the actual condition of the object;
2. problem of evaluating and identifying the problematic control situation;
3. problem of analyzing the problematic situation of control;
4. problem of adopting decisions and bringing them to the object of control.

The fourth principle is the structural unity of the control loops (the structure of the loop models of the processes for adopting local and system decisions is constant and independent of the control level).

The use of a uniform and standardized (typical) structure of loop models for the processes of adopting decisions insures a spatial-time compatibility of the loops in the multilevel hierarchy of enterprise control. The model of such

compatability of three control loops or a hierarchic loop module is shown in Fig. 2, where the control objects of the upper level are two control loops of the lower level.

The fifth principle is doing a sequence of work in which all problems of one control loop are simultaneously optimized and automated, while the automation of all problems of several interrelated loops, located along vertical, as well as horizontal ties is considered a stage of creating the ASU. When including the adjacent control loops from various subsystems of one level in the creation stage of the ASU, it is necessary to consider loops of the system control of a given level.

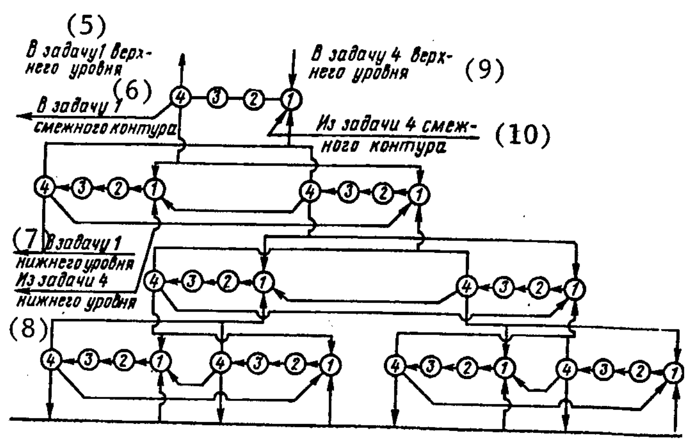

Fig. 3. Loop control network

5. To problem 1 of upper level;
6. To problem 1 of adjacent loop;
7. To problem 1 of lower level;
8. From problem 4 of lower level;
9. To problem 4 of upper level;
10. From problem 4 of adjacent loop.

By using hierarchic loop modules as basic design components, it is possible to represent the entire multilevel hierarchy of enterprise control in the form of a loop control network. A fragment of such a network is shown in Fig. 3

(in circles are shown the numbers of problems as shown in Fig. 2). As already mentioned above, depending upon the condition of the hierarchy of the problematic situations and the necessity of corresponding conditions of the hierarchy of local and system decisions, some ties along the vertical and horizontal may disappear and appear, and some loops may become inoperative, while others, conversely may become active, etc.

Therefore, the sixth principle that must be taken into account in making decisions on coordinated hierarchic enterprise control is the principle of instability of the structural ties in the loop networks. This must be especially taken into account when developing optimizing structural models for coordinating hierarchic decisions in problematic control situations.

The proposed principles may be laid at the basis of designing and investigating loop models of processes for adopting decisions and creating optimization structural models for coordinating decisions in enterprise control.

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PROCESS CONTROLS AND AUTOMATION ELECTRONICS

IN-PROCESS CONTOURING CONTROLLER FOR TURBINE BLADE PRODUCTION

Moscow MASHINOSTROITEL' in Russian No 3, Mar 84 p 24

[Article by M. D. Medvedev, engineer]

[Text] An automated contour controller for large blades (500 to 1600 mm long) was introduced in the "Turbolopatka Production Association (Leningrad). The complex consists of device 1 (BV-2019), indication unit 3, control unit 4, interpolator 5, computer 6 (SM-1) and printer 8. Coded reports are made on blade 2 to be monitored, and a control program for the device is prepared by an EVM-1022 computer by a "Secheniye" SAP [Automatic design system]. It measures the contour deviations from all given cross sections and this data is sent to and processed by an SM-1 computer. The results are printed in the form of a statement 7 (for each cross section separately) which contains deviations in the shape of a given number of points, the contour shift along two coordinates and its slewing, the thickness of the contour at the zenith and the edge. The use of such a complex for operational output quality control of the contour makes it possible to eliminate entirely measurements by gages, increase the productivity of control, insuring its production fully according to the drawing. The introduction of the complex saves 30,000 to 40,000 rubles.

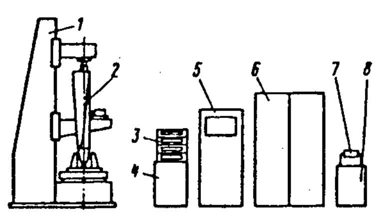

Fig. Contour controller complex

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MATHEMATICAL MODEL FOR SERVICE LIFE OF TOOLING

Moscow EKONOMIKA I MATEMATICHESKIYE METODY in Russian No 2, Feb 84 (manuscript received 17 Aug 81) pp 352-355

[Abstract of article by Sonin, I. M. and Aliyev, I. A., Moscow, Baku]

[Abstract] Sometimes the service life of equipment is determined by a certain level of profitability in utilization, rather than by technical factors such as breakage, or departure of equipment parameters beyond permissible limits. In such cases, operable equipment is taken out of service after a certain period called the "normative service life," and it may not be clear beforehand how reliability in the sense of the property of an item to retain its operability is related to the normative and actual service life. Based on the example of a very simple stochastic model, the authors show that a reduction in equipment reliability defined as an increase in probability of failure during each period of utilization leads to an increase in the optimum normative service life. This does not imply an increase in the mathematical expectation of the actual service life. It only means that items of unreliable equipment that fortuitously have not failed before the replacement time will be replaced later than their more reliable counterparts in service up to this point. Since the fraction of equipment that will not last until replacement is greater in the unreliable group than in the reliable group, the actual service life of the former must be shorter. It is assumed that equipment has a fixed initial value, and that each successive period of utilization involves additional overhead expenses. The equipment has constant productivity, does not fail during utilization, and is retired and replaced with equipment of the same value after the normative service life. It is shown that the optimum normative service life in the stochastic case is longer than in the deterministic case for the same equipment values and overhead expenses. Figure 1, references 8: 7 Russian, 1 Western. [231-6610]

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UDC 658.511.2: 681.3

COMPUTERIZED IN-PLANT RESOURCES PLANNING SYSTEM DEVELOPED

Moscow MASHINOSTROITEL' in Russian No 3, Mar 84 pp 35-36

[Article by V. G. Rakov, "Automated Analysis of Material Resources at Enterprises"]

[Text] One of the most important sections of a comprehensive economic analysis of the production-economic activity of a machinebuilding enterprise is the analysis of material resources. It is possible o raise its quality and efficiency by using an economical-mathematical method and modern computers.

The Moscow Financial Institute summarized advanced experience in making an analysis of material resources at the following enterprises: the Moscow "Krasnyy proletariy" Machine Tool Building PO [Production association], the Moscow "Frezer" Tool Plant imeni M. I. Kalinin, the"Zil" PO, the Gorlovsk Machine Tool Building Plant imeni S. M. Kirov and the Minsk Automatic Lines Plant imeni P. M. Masherov. It was established that the use of modern computers (Yes EVM [Single system computer]) that are fast, have high capacity immediate access and external memories, a powerful operational system, and a wide set of peripheral devices, makes it possible to process and store huge volumes of economic data, and implement integrated data processing by creating an automatic data bank (ABD).

With an automated data processing system (ASOD), calculation for analyzing material resources are comprehensive, complete and thorough because this method has the following factors:

calculations span all stages of analysis (operational, current and long-range), while manual and mechanized calculations basically make the current (next) analysis of materials resources;

at each stage, the analysis of calculations spans the necessary enumeration of analytical problems for all material operations which provides for obtaining all the data on labor objects;

the analysis of material resources is made on the general plant level (for each enterprise as a whole) as well as on the intraplant level (in shops, sections, brigades and work positions);

the systematic nature of the analysis is insured by a certain step-by-step manner of making the calculations, their coordination, by using the ABD which makes it possible to subordinate them to a single target. Here the accent is on the side of operational analyses carried out on a number of problems daily. At the end of each report period (month, quarter, year, five-year plan) a current comprehensive analysis of material resources is made. To substantiate and forecast long-range plans, a long-range analysis can be made. All stages of the analysis are interrelated. The planning, accounting, analytical and reference-norm data in the ABD ecessary for the analysis are interrelated and coordinated which insures accuracy, authenticity and efficiency of the analytical calculations.

The ASOD makes it possible to obtain analytical data with the maximum necessary degree of detailing. Thus, a detailed analysis can be made of using all material items in any profiles (for products, shops, sections etc.), an analysis of deviations in material resources consumption from norms with the indication of specific causes, technical-economic and organizatonal factors responsible executers and offenders for all levels of management which increases its efficiency and insures purposeful management.

In nonautomated systems an analysis of materials utilization at machinebuilding enterprises is done by groups (steel: large size, small size, thick sheet, thin sheet etc.) Deviation analysis is made by the "boiler" method. Thus, in analyzing material consumption deviations from plan or norm indicators, specific causes and culprits are not identified. This is due to the fact that the current analysis is made on the basis of accounting and statistical reports, and to the huge volumes of data with manual data processing which make it impossible to make a more detailed analysis.

Moreover, an analysis of implementing plans for the procurement of material resources is made on limited material items (basic and scarce); it is difficult to analyze the completeness and quality of deliveries and their regularity in view of the labor-intensiveness of making such an analysis manually. Therefore, it is difficult to prevent critical situations that originate in supplying enterprises with material resources. This results in warehouses being overstocked with materials above norms, production is interrupted and unsubstantiated material is substituted which reduces the production-economic efficiency of the enterprise.

With the ASOD it is possible to monitor and analyze daily the plan implementation for the procurement of all items of material resources from suppliers and the completeness, quality and regularity of deliveries. Moreover, it is possible to anticipate critical situations beforehand and take measures to prevent them.

For example, according to the plan, a certain amount of material must be received from the supplier in the first 10 days of the month. Having set the critical point for receiving the material, for example, as two days before the end of the 10-day period, we analyze the delivery plan on the computer daily. Having solved the given problem on the eighth of the month, we obtain a warning that the material has not yet been delivered. On obtaining this information the worker in the material-equipment procurement department

contacts the suppler to find out when the material will be delivered and take the necessary measures. Critical points may be set differently for each supplier (or material depending upon its scarcity, average daily consumption, frequency and volume of deliveries, and remoteness of the supplier) and also obtain daily operational analytical data on the implementation of the procurement plan, printing out only items for which there are deviations or those that have reached the critical points.

The ASOD makes it posible to solve such problems as those that could not be solved manually and by mechanized data processing, for example, problems of operational and long-range analysis. Computers can be used at the operational analysis stage to adopt solutions on the basis of economic-mathematical methods, including optimizing ones (for example, in selecting the most efficient version of substituting materials in each specific production situation). At the stage of current analysis, the use of the economic-mathematical methods makes it possible to make an in-depth analysis of the utilization of material resources indicators. Thus, in analyzing material consumption in production by modern methods of factor analysis (for example, the integral method of evaluating factor effects), it is possible to analyze more precisely and with better quality such factors as the change in the material consumption norms, the change in the prices of materials, substitution of materials, and structural shifts in the production output in the report period. Calculations for long-range analysis are based on statistical methods (correlation, estimate-analytical etc.). For example, for the long-range analysis of material consumption indicators, the method of extrapolation of past trends can be used.

With the ASOD the technology changes for forming initial data for the current analysis of material resources, which may be received and placed in the ABD in the process of solving corresponding problems on planning and accounting for material resources, and not as a result of processing industrial-financial plans and state report forms (they are basic sources of data in manual and mechanical data processing). In this case, it becomes possible to utilize the results of the current analysis of material resources for a month, quarter, or year for the following period (month, quarter, year). Of course, this is possible only at the corresponding level of automatic plan and accounting work in the ASOD.

Special features of analyzing material resources in the ASOD call for the necessity of changing existing methods, oriented toward manual data processing. Thus, the methodology of the analysis of the economic activity of an industrial enterprise should include the following: targets and problems of analysis; totality of its indicators; arrangements between their interrelationships; sequence of the analysis; periodicity and schedules for doing it; data sources; specific analysis methods, order of formulation of results and their evaluation; specific services and people responsible for the organization of the analysis and its implementation; system of computers and organizational equipment; evaluation of the labor-intensiveness of the analytical work.

The primary problem in using the ASOD is to develop a method for analyzing material resources that has essential distinctions:

the periodicity and schedules of making the analysis change, and the total number of problems being solved increases;

data sources change;

analysis methods, the order of formulating results and their evaluation change;

the organization of analysis, the services and people responsible for making it change, in connection with the redistribution of functions between the subdivisions of an enterprise;

new in principle computers are used that make it possible to automate the processes of gathering, processing and issuing data;

labor-intensiveness of making the analysis is reduced.

Thus, with the ASOD a qualitatively new mechanism is produced to implement the functions of analyzing material resources that provide an improvement in control processes in machinebuilding production.

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